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CANCER FACTS & FIGURES–1992

AMERICAN CANCER SOCIETY®

Estimated number of new cancer cases in 1992 by state, total: 1,130,000 (excluding Puerto Rico).*

*Excluding nonmelanoma skin cancer and carcinoma in situ
BASED ON RATES FROM NCI SEER PROGRAM (1986-1988).

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*Table/Chart

SOURCES OF STATISTICS

Incidence

Since there is no nationwide cancer registry, there is no way of knowing exactly how many new cases of cancer are diagnosed each year. The ACS estimates cancer incidence for the upcoming year using the best available data sources at the time.

Estimates of cancer incidence in Facts and Figures editions prior to 1974 were based on rates from two state cancer registries, the Connecticut Tumor Registry and the New York State Tumor Registry. The issues from 1974 to 1978 used information from the National Cancer Institute's Third National Cancer Survey (1969-1971) of nine major areas of the United States. In 1973, the NCI began the Surveillance, Epidemiology and End Results (SEER) program to collect ongoing data on cancer incidence and patient survival. The SEER program includes data from nine population based cancer registries, covering about ten percent of the U.S. population. Beginning with the 1979 edition of Facts and Figures, estimates of cancer incidence have been based on incidence rates obtained through the SEER program, applied to the U.S. Census estimates of the population for the current year.

It is not appropriate or accurate to evaluate cancer incidence and mortality trends using only ACS estimates of cases and deaths, since these numbers are projected before the year begins, using incidence rates that are several years old. The numbers are presented to give the best available measure of the scope of the disease in the U.S. at the time of publication. Comparable incidence rates are available for 1973 through 1988 from the National Cancer Institute's SEER program to evaluate cancer trends.

The estimates of total U.S. cancer cases diagnosed in 1992 are based on age-specific incidence rates from the SEER program for 1986-1988 applied to the 1992 Census population projections. Some adjustment is made for sites with recently increasing or decreasing rates. Estimated new cases by state are calculated according to the distribution of estimated 1992 cancer deaths by state for each primary cancer site.

Mortality

The source of mortality statistics for Cancer Facts and Figures has always been the Division of Vital Statistics, National Center for Health Statistics, Department of Health and Human Services.

The 1992 estimates of cancer deaths are based on cancer mortality data from 1982 through 1988.

Beginning with the 1981 edition of Facts and Figures, age-adjusted mortality rates per 100,000 are standardized to the 1970 census population distribution, rather than the 1940 census population. Age-adjustment or age-standardization is a method used to make valid statistical comparisons among rates by assuming the same age distribution occurs among the different groups being compared.

Death rates by state: In the 1990, 1991, and 1992 Cancer Facts and Figures actual age-adjusted mortality rates, based on reported deaths in a recent period, are presented. For Facts and Figures 1969 through 1987 crude death rates were projected for the current year. For Facts and Figures 1988 and 1989, age-adjusted death rates were projected. These rates are not comparable and should not be used to evaluate trends over time.

Cancer Around the World: International mortality rates were calculated from data made available by the World Health Organization and published in the World Health Statistics Annuals. Beginning with the 1992 edition of Facts and Figures, mortality rates are standardized to the world population rather than the 1970 U.S. population.

Survival

Cancer survival statistics are usually reported as five-year relative survival rates. In this edition, we present survival statistics for cases diagnosed in the period 1981-1987, as reported from the SEER program. The relative survival rate is the ratio of the observed survival rate for the patient group to the expected survival rate for persons in the general population similar to the patient group with respect to age, sex, race and calendar year of observation. Because there is a certain lag time required in measuring survival, these rates may not reflect the most recent treatment advances.

Changes in 1992

30-Year Trends in Cancer Death Rates (p. 4): Actual cancer deaths for 1988 and 1958 are presented with percent rate changes to further describe the burden of cancer in recent versus past years.

Skin melanoma deaths: Expected deaths from melanoma of the skin are presented in the body of the table (p. 5), rather than the footnote. Other skin cancer death estimates are footnoted.

Puerto Rico: Estimated deaths in Puerto Rico were based on reported deaths from 1983 through 1989. Case estimates have been updated to reflect the availability of incidence data through 1989.

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Cancer: Basic Facts

What is cancer?

Cancer is a group of diseases characterized by uncontrolled growth and spread of abnormal cells. If the spread is not controlled, it can result in death. Many cancers can be cured if detected and treated promptly. Many others can be prevented by lifestyle changes, especially avoidance of tobacco.

What causes cancer?

Cancer is caused by both external (environment) and internal (host) factors. Environmental causes include chemicals, radiation, and viruses. Host causes include hormones, immune conditions, and inherited mutations. Causal factors may act together or in sequence to initiate or promote carcinogenesis. Ten or more years often pass between exposures or mutations and detectable cancer.

How is cancer prevented?

Avoiding potential oncogenic exposures (tobacco use, sun exposure, excess dietary fat) prevents the initiation or promotion of cancer (primary prevention). Early detection and treatment (see breast and cervix cancers) improve survival rates and reduce mortality (secondary prevention).

How is cancer treated?

By surgery, radiation, radioactive substances, chemicals, hormones, and immunotherapy.

Who gets cancer?

Cancer can occur at any age. Since incidence rises with age, most cases affect adults in mid-life or beyond. Among children ages 1–14, cancer causes more deaths in the US than any other disease. In the 1980s there were estimated to be over 4.5 million cancer deaths, almost 9 million new cancer cases and some 12 million people under medical care for cancer.

How many people alive today will get cancer?

About 83 million Americans now living will eventually have cancer; about one in three, according to present rates.

How many people alive today have ever had cancer?

Over 8 million Americans alive today have a history of cancer, 4 million diagnosed five or more years ago. Most of these 4 million can be considered cured, while others still have evidence of cancer. "Cured" means that a patient has no evidence of disease and has the same life expectancy as a person who never had cancer.

The decision as to when a patient may be considered cured is made by the examining physician. For most forms of cancer, five years without symptoms following treatment is usually accepted as "cured." In some cases, patients can be considered cured in less time, but others have to be observed longer.

How many new cases will there be this year?

In 1992 about 1,130,000 people will be diagnosed as having cancer. This estimate does not include carcinoma in situ and basal and squamous cell skin cancers. The incidence of these skin cancers is estimated to be over 600,000 cases annually.

How many people will die?

This year about 520,000 will die of cancer—about 1,400 people a day. Of every five deaths in the US, one is from cancer. In 1991 an estimated 514,000 Americans died of cancer.

What is the national cancer death rate?

There has been a steady rise in the cancer mortality rate in the US in the last half-century. The age-adjusted rate in 1930 was 143 per 100,000 population. It rose to 152 by 1940, to 158 in 1950, and has been about 170 since 1984. The major cause of this increase has been lung cancer. Death rates for many major cancer sites have leveled off or declined over the past 50 years (see page 3).

How many people are surviving cancer?

In the early 1900s few cancer patients had any hope of long-term survival. In the 1930s less than one in five was alive at least five years after treatment. In the 1940s it was one in four, and in the 1960s it was one in three.

Today, about 452,000 Americans, or 4 of 10 patients who get cancer this year, will be alive 5 years after diagnosis. The gain from 1 in 3 to 4 in 10 represents about 79,000 persons this year. This 4 in 10, or about 40% is called the "observed" survival rate. When normal life expectancy is taken into consideration (factors such as dying of heart disease, accidents, and diseases of old age) a "relative" five-year survival rate of 51% is seen for all cancers. The relative survival rate is commonly used to measure progress in the early detection and treatment of cancer and estimates the proportion of cancer patients potentially curable.

Could more people be saved?

Regular screening and self-exams can detect cancers of the breast, tongue, mouth, colon, rectum, cervix, prostate, testis, and melanoma at an early stage when treatment is more likely to be successful. These sites include nearly half of all new cases. Of these cases, about two-thirds of all patients currently survive five years. With early detection about 89% would survive. This means that of those persons diagnosed with these cancers in 1992, about 100,000 more would survive if their cancers had been detected in a localized stage and treated promptly. In addition, about 90% of the 600,000 skin cancers to be diagnosed in 1992 could have been prevented by protection from the sun's rays. All cancers caused by cigarette smoking and heavy use of alcohol could be prevented completely. The ACS estimates that in 1992, about 158,000 lives will be lost to cancer because of tobacco smoking. About 16,500 cancer deaths will be related to excessive alcohol use, frequently in combination with cigarette smoking.

HOW CANCER WORKS

Normally, the cells that make up the body reproduce in an orderly manner, so that worn-out tissues are replaced, injuries are repaired, and the body stays healthy.

Occasionally, certain cells undergo a change that is abnormal, and thus begin a process of uncontrolled growth and spread. These cells may grow into masses of tissue called tumors. Some tumors are benign and others are malignant (cancerous).

The danger of cancer is that it invades and destroys normal tissue. In the beginning, cancer cells usually remain at their original site, and the cancer is said to be localized. Later, cancer cells may invade distant or neighboring organs or tissue. This occurs either by direct extension of growth, or by metastasis whereby cells become detached and are carried through the lymph or blood systems to other parts of the body.

Metastasis may be regional—confined to one region of the body—when cells are trapped by nearby lymph nodes. If left untreated, however, the cancer may spread throughout the body. That condition is known as advanced cancer, and usually results in death.

Systems have been designed to define what stage a cancer has reached. Because cancer becomes more serious with each stage, it is important to detect cancer as early as possible. (See p. 18, Cancer-Related Checkup Guidelines.)

TRENDS IN DIAGNOSIS AND TREATMENT

The diagnosis and treatment of cancer has become increasingly individualized. Early detection is followed by more precise staging, and the use of more than one kind of therapy, often in combination.

Some cancers that, only a few decades ago, had a very poor outlook, are often being cured today: acute lymphocytic leukemia in children, Hodgkin's disease, Burkitt's lymphoma, Ewing's sarcoma (a form of bone cancer), Wilms' tumor (a kidney cancer in children), rhabdomyosarcoma (a cancer in certain muscle tissue), choriocarcinoma (placental cancer), testicular cancer, and osteogenic sarcoma. Other cancers have not yet yielded to effective treatment, and are the focus of continuing research.

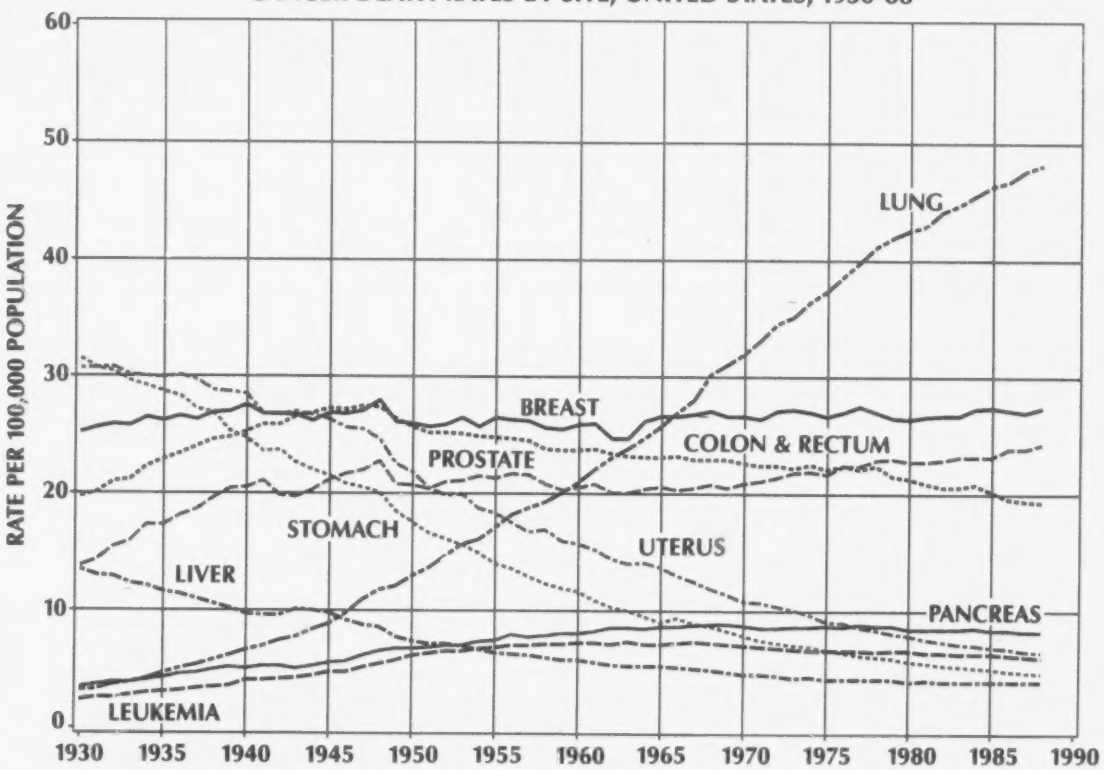
An outstanding example of progress is the improvement in the management of testicular cancer in young men. More precise diagnostic tools and staging allow better selection of treatment. The use of combinations of cancer drugs has resulted in remarkably improved survival. In 20 years, the 5-year survival rate of testicular cancer rose from 63% to 91%.

The following developments indicate the directions of current and future research:

- New findings in genetics are revealing the importance of **oncogenes**. These genes are found in tumor cells. Their activation is associated with the transformation of normal cells into cancer cells. Analysis of products of these oncogenes is a promising new means to predict which tumors are likely to recur after surgery or to identify family members at risk.
- Use of potent **growth factors** stimulates normal bone marrow cells to withstand very high doses of chemotherapeutic drugs.
- A genetic fusing of cancer cells with normal cells can produce disease-fighting **monoclonal antibodies** (specific antibodies tailored to seek out chosen targets on cancer cells). Their potential in the diagnosis and treatment of cancer is under study.
- New ways have been found to treat early breast and colon cancers with drugs postoperatively. This **"adjuvant" treatment** may eradicate cancer cells remaining after surgery and increase cure rates.
- **Neoadjuvant chemotherapy** (giving chemotherapy to shrink the cancer and then removing it surgically) has been successful against certain types of cancers.
- New understanding of the causes of pain in cancer patients has increased the **options for controlling pain**. Regular use of orally administered pain medicines, infusions or injections of analgesics, and procedures to interrupt pain pathways are among the effective approaches available.
- Researchers are examining **synthetic retinoids** (cousins of vitamin A) and other substances to see if recurrences of certain cancers can be prevented. Another step is to see if these agents can reduce cancer in high-risk groups.
- In clinical trials, an agent, **taxol**, obtained currently from the bark of yew trees, has been effective in treating ovarian cancer.
- New approaches to drug therapy use **combinations of chemotherapeutic drugs, or chemotherapy plus surgery or radiation.** New classes of agents are being tested for their effectiveness in treating patients whose disease is resistant to drug therapies now in use.
- Many patients with primary bone cancer now are treated successfully by **removing and replacing a section of bone** rather than by amputating the leg or arm. Drugs and radiation therapy are being used effectively after bone cancer surgery, resulting in dramatic improvement in survival.
- **New high-technology diagnostic imaging techniques** have replaced exploratory surgery for some cancer patients. Magnetic resonance imaging (MRI) is one example of such technology. In MRI, a huge electromagnet is used to detect hidden tumors by mapping, on a computer screen, the vibrations of the various atoms in the body. Computerized tomography (CT) scanning uses x-rays to examine parts of the body. In both of these painless, non-invasive procedures, cross-section pictures can show a tumor's shape and location more accurately than is possible with conventional x-ray techniques. For patients undergoing radiation therapy, CT scanning may enable the therapist to pinpoint the tumor more precisely, and thus provide more accurate radiation dosage while sparing normal tissue.

- **Immunotherapy** holds the hope of enhancing the body's own disease-fighting systems to control cancer. **Interferon** (naturally occurring body proteins that are capable of killing cancer cells or stopping their growth), **interleukin-2** (a growth factor that greatly stimulates cells of the immune system to directly fight cancer), and other **biologic response modifiers** are under study. Recently, interferon was made available as the treatment for hairy cell leukemia, a rare blood cancer of older Americans. Interleukin-2 is under very active research in the treatment of kidney cancer and melanoma.
- Many cancers are caused by a two-stage process through exposure to substances known as **initiators and promoters**. Research scientists are exploring ways of interrupting this process to prevent the development of cancer.
- New technologies have made it possible to use **bone marrow transplantation** as an important treatment option in selected patients with leukemia, and bone marrow transplantation for other cancers is under study. Because disruption of bone marrow function is a side effect of some cancer treatments, researchers are evaluating **autologous bone marrow transplants**, in which a portion of the patient's own marrow is removed before treatment, saved, and later restored. This procedure eliminates the problems of matching a donor with the recipient patient, and may make it possible for the patient to tolerate larger doses of anticancer drugs or radiation therapy.
- **Hyperthermia** is a way to increase the heat or temperature of the entire body or a part of the body. It is known that heat can kill cancer cells. A cell temperature of 45° centigrade kills cancer cells. A temperature of 42°–43° centigrade makes the cell more susceptible to damage by ionizing radiation (x-rays). Studies are underway to learn if hyperthermia can increase the effect of radiation or chemotherapy.
- With medical progress producing longer survival periods for many cancer patients, clinical concerns are expanding to include not only patients' physical well-being, but also their **psychosocial needs**. The response of both patient and family to the disease, the patient's sexual concerns, employment and insurance needs, and ways to provide psychosocial support have emerged as important areas of research and clinical care.
- Improvements in cancer treatment have made possible more **conservative management** of some early cancers. In early cancer of the larynx, many patients are now able to retain the larynx and voice; in colorectal cancer, fewer permanent colostomies are needed; and in many cases, the surgery for breast cancer is often more limited.
- **Prostatic ultrasound** (a rectal probe using ultrasonic waves to produce an image of the prostate) is currently being investigated as a potential means to increase the early detection of occult (not clinically suspected) prostate cancer.

CANCER DEATH RATES BY SITE, UNITED STATES, 1930-88



Rates are adjusted to the age distribution of the 1970 census population.
Sources of Data: National Center for Health Statistics and Bureau of the Census, United States.
Note: Rates are for both sexes combined except breast and uterus (female population only) and prostate (male population only).

30-YEAR TRENDS IN CANCER DEATH RATES* BY SITE AND SEX, 1956–58 to 1986–88

SITES	SEX	1956–58	1986–88	PERCENT CHANGE	NUMBER OF DEATHS 1958	NUMBER OF DEATHS 1988
ALL SITES	Male	180.1	216.4	+ 20	134,878	258,088
	Female	139.9	139.4	†	119,648	226,960
ORAL	Male	6.1	4.7	- 23	4,421	5,497
	Female	1.5	1.7	+ 13	1,345	2,702
ESOPHAGUS	Male	4.8	5.7	+ 20	3,649	6,916
	Female	1.2	1.5	+ 25	963	2,420
STOMACH	Male	18.7	7.0	- 62	13,089	8,105
	Female	9.7	3.2	- 67	7,944	5,571
COLON & RECTUM	Male	25.3	24.0	- 5	18,420	28,111
	Female	23.0	16.8	- 27	19,347	28,997
COLON	Male	16.9	20.4	+ 21	12,271	23,987
	Female	17.4	14.6	- 16	14,632	25,400
RECTUM	Male	8.4	3.6	- 57	6,149	4,124
	Female	5.7	2.1	- 36	4,715	3,597
LIVER‡	Male	6.0	5.0	- 16	4,360	6,053
	Female	6.3	3.2	- 49	5,276	5,475
PANCREAS	Male	9.9	9.9	†	7,480	11,722
	Female	6.2	7.1	+ 15	5,271	12,126
LARYNX	Male	2.6	2.5	†	2,010	2,965
	Female	0.2	0.5	+ 114	231	702
LUNG	Male	33.4	73.7	+ 121	27,527	88,059
	Female	5.4	28.2	+ 425	4,789	45,225
MELANOMA OF SKIN	Male	1.3	2.9	+ 126	1,078	3,585
	Female	1.0	1.5	+ 55	894	2,394
OTHER SKIN	Male	1.7	1.2	- 29	1,117	1,439
	Female	1.0	0.4	- 62	716	662
BREAST	Male	0.3	0.2	- 22	215	289
	Female	26.0	27.2	†	22,460	42,172
CERVIX UTERI	Female	9.8	3.1	- 69	8,582	4,443
OTHER UTERUS	Female	7.4	3.6	- 52	6,358	5,914
OVARY	Female	8.8	7.9	- 10	7,579	12,397
PROSTATE	Male	21.4	24.0	+ 12	14,071	28,982
BLADDER	Male	7.2	5.6	- 22	5,074	6,534
	Female	2.9	1.7	- 42	2,305	3,271
KIDNEY	Male	3.7	5.0	+ 35	2,962	5,855
	Female	1.9	2.4	+ 22	1,781	3,814
BRAIN	Male	4.0	5.0	+ 24	3,303	6,076
	Female	2.6	3.3	+ 25	2,303	4,867
NON-HODGKIN'S LYMPHOMA	Male	4.6	7.2	+ 56	3, 616	8, 892
	Female	3.0	4.8	+ 59	2, 696	8,367
HODGKIN'S DISEASE	Male	2.3	0.8	- 67	1,838	945
	Female	1.4	0.5	- 67	1,198	663
MULTIPLE MYELOMA	Male	1.8	3.5	+ 96	1, 492	4,231
	Female	1.3	2.4	+ 87	1,111	4, 087
LEUKEMIA	Male	8.7	8.1	†	6,956	9,724
	Female	5.8	4.8	- 16	5,024	7,853

*Adjusted to the age distribution of the 1970 US Census Population.
†Percent change not listed because it is not meaningful.
‡Primary and non-specified.
NOTE: Even though death rates declined or remained stable, the number of deaths increased because the population has become larger and older. The US population increased 41% from 1958 to 1988.

ESTIMATED NEW CANCER CASES AND DEATHS BY SEX, ALL SITES—1992*

	ESTIMATED NEW CASES			ESTIMATED DEATHS		
	Total	Male	Female	Total	Male	Female
ALL SITES	1,130,000	565,000	565,000	520,000	275,000	245,000
Buccal cavity & pharynx (Oral)	30,300	20,600	9,700	7,950	5,175	2,775
Lip	3,600	3,100	500	100	75	25
Tongue	6,000	3,900	2,100	1,850	1,200	650
Mouth	11,500	6,900	4,600	2,200	1,300	900
Pharynx	9,200	6,700	2,500	3,800	2,600	1,200
Digestive organs	241,000	127,100	113,900	120,800	63,950	56,850
Esophagus	11,100	7,900	3,200	10,000	7,500	2,500
Stomach	24,400	15,000	9,400	13,300	8,000	5,300
Small intestine	3,400	1,900	1,500	950	500	450
Large intestine (Colon-Rectum)	111,000	54,000	57,000	51,000	25,000	26,000
Rectum (Colon-Rectum)	45,000	25,000	20,000	7,300	3,900	3,400
Liver & biliary passages	15,400	8,200	7,200	12,300	6,600	5,700
Pancreas	28,300	13,900	14,400	25,000	12,000	13,000
Other & unspecified digestive	2,400	1,200	1,200	950	450	500
Respiratory system	185,000	115,000	70,000	151,000	96,800	54,200
Larynx	12,500	10,000	2,500	3,650	2,900	750
Lung	168,000	102,000	66,000	146,000	93,000	53,000
Other & unspecified respiratory	4,500	3,000	1,500	1,350	900	450
Bone	2,000	1,100	900	1,050	550	500
Connective tissue	5,900	3,200	2,700	3,300	1,600	1,700
Melanoma of skin	32,000	17,000	15,000	6,700	4,100	2,600
Breast	181,000	1,000	180,000	46,300	300	46,000
Genital organs	211,100	139,600	71,500	58,550	34,550	24,000
Cervix uteri (Uterus)	13,500	—	13,500	4,400	—	4,400
Corpus & unspecified (Uterus)	32,000	—	32,000	5,600	—	5,600
Ovary	21,000	—	21,000	13,000	—	13,000
Other & unspecified genital, female	5,000	—	5,000	1,000	—	1,000
Prostate	132,000	132,000	—	34,000	34,000	—
Testis	6,300	6,300	—	350	350	—
Other & unspecified genital, male	1,300	1,300	—	200	200	—
Urinary organs	78,100	54,700	23,400	20,200	12,700	7,500
Bladder	51,600	38,500	13,100	9,500	6,300	3,200
Kidney & other urinary	26,500	16,200	10,300	10,700	6,400	4,300
Eye	1,700	900	800	275	125	150
Brain & central nervous system	16,900	9,100	7,800	11,800	6,500	5,300
Endocrine glands	13,900	4,200	9,700	1,675	750	925
Thyroid	12,500	3,400	9,100	1,000	400	600
Other endocrine	1,400	800	600	675	350	325
Leukemia	28,200	16,000	12,200	18,200	9,900	8,300
Lymphocytic leukemia	11,800	7,000	4,800	5,200	3,000	2,200
Granulocytic leukemia	11,300	6,100	5,200	7,400	3,900	3,500
Other & unspecified leukemia	5,100	2,900	2,200	5,600	3,000	2,600
Other blood & lymph tissues	60,900	33,500	27,400	30,100	15,600	14,500
Hodgkin's disease	7,400	4,200	3,200	1,500	900	600
Non-Hodgkin's lymphoma	41,000	23,000	18,000	19,400	10,000	9,400
Multiple myeloma	12,500	6,300	6,200	9,200	4,700	4,500
All other & unspecified sites	42,000	22,000	20,000	42,100	22,400	19,700

*Carcinoma in situ and nonmelanoma skin cancers are not included in totals. Carcinoma in situ of the uterine cervix accounts for about 55,000 new cases annually, carcinoma in situ of the female breast accounts for about 20,000 new cases annually, and melanoma carcinoma in situ accounts for about 8,000 new cases annually. Overall, about 100,000 new cases of carcinoma in situ of all sites of cancer are diagnosed each year.

Basal cell and squamous cell skin cancers account for more than 600,000 new cases annually. About 2,100 nonmelanoma skin cancer deaths will occur in 1992.

INCIDENCE ESTIMATES ARE BASED ON RATES FROM NCI SEER PROGRAM 1986–88.

ESTIMATED NEW CANCER CASES, BY STATE—1992

	ALL SITES*	SELECTED SITES								
STATE	Number of Cases	Female Breast	Colon & Rectum	Lung	Oral	Uterus	Prostate	Skin Melanoma	Pancreas	Leukemia
Alabama	20,200	2,700	2,300	3,200	600	900	2,400	500	500	450
Alaska	1,200	175	125	250	50	50	100	50	40	40
Arizona	16,000	2,400	2,000	2,500	300	600	1,900	500	350	450
Arkansas	12,600	1,700	1,700	2,300	250	425	1,500	325	325	350
California	116,000	18,000	15,000	17,000	3,200	4,600	13,000	3,700	3,000	3,100
Colorado	10,600	1,800	1,500	1,400	275	350	1,400	400	300	300
Connecticut	15,800	2,700	2,400	2,200	450	550	1,600	425	425	375
Delaware	3,300	600	475	500	100	125	400	100	70	80
Dist. of Columbia	3,800	600	550	500	125	225	600	80	80	90
Florida	76,000	11,200	10,600	12,000	2,500	2,600	9,600	2,200	2,000	1,800
Georgia	26,500	4,400	3,100	4,100	1,000	1,000	3,300	850	650	600
Hawaii	3,600	425	600	500	125	125	375	80	100	75
Idaho	3,800	500	550	500	100	200	550	125	125	100
Illinois	53,000	8,600	8,100	7,600	1,200	2,400	5,800	1,300	1,400	1,300
Indiana	26,500	4,100	3,600	4,100	600	1,000	3,000	650	600	650
Iowa	13,500	2,300	2,100	2,000	400	450	1,800	425	325	325
Kansas	11,000	1,800	1,700	1,600	225	475	1,400	325	275	325
Kentucky	18,000	2,400	2,300	3,300	400	750	1,700	475	375	350
Louisiana	19,500	2,600	2,400	3,200	600	900	2,200	400	550	425
Maine	6,400	850	950	900	200	275	650	175	150	150
Maryland	21,600	3,500	2,900	3,300	550	750	2,400	550	550	500
Massachusetts	29,600	5,400	4,500	4,000	900	1,100	3,200	900	700	700
Michigan	40,600	6,600	5,200	6,000	1,100	1,700	4,900	800	1,000	1,000
Minnesota	18,400	3,200	2,600	2,300	425	700	2,600	475	550	550
Mississippi	12,500	1,700	1,600	2,000	325	550	1,500	275	350	275
Missouri	24,900	3,900	3,300	4,000	500	900	2,900	650	600	600
Montana	3,500	450	550	500	125	125	500	125	90	80
Nebraska	7,100	1,200	1,000	1,100	100	225	850	300	175	175
Nevada	5,300	750	600	950	125	175	425	150	150	125
New Hampshire	5,100	900	750	700	150	200	650	125	125	100
New Jersey	39,400	6,700	6,100	5,400	1,100	1,700	4,100	1,200	900	900
New Mexico	5,200	900	750	600	100	200	700	175	150	175
New York	87,000	15,900	13,700	11,400	2,600	3,600	9,500	2,600	2,300	1,900
North Carolina	30,000	5,100	4,000	4,700	900	1,300	4,000	1,000	800	700
North Dakota	2,900	425	425	375	80	125	500	80	80	100
Ohio	52,500	8,600	7,600	8,000	1,300	2,300	5,700	1,200	1,200	1,300
Oklahoma	14,800	2,100	1,800	2,400	450	700	1,600	450	350	400
Oregon	13,700	2,100	1,700	2,100	350	600	1,800	450	350	350
Pennsylvania	66,000	10,700	10,000	9,300	1,400	2,800	7,700	1,800	1,500	1,800
Rhode Island	5,300	1,000	800	750	225	200	600	125	125	100
South Carolina	14,500	2,300	1,800	2,300	600	700	1,900	450	375	400
South Dakota	3,200	550	500	450	50	100	500	100	90	100
Tennessee	23,500	3,600	3,200	4,000	550	1,100	2,700	700	550	600
Texas	60,000	8,700	7,100	9,000	1,500	2,400	6,100	1,700	1,500	1,700
Utah	4,000	700	550	350	90	225	600	150	125	125
Vermont	2,400	475	325	350	50	90	400	75	60	80
Virginia	26,400	4,300	3,400	4,200	700	1,000	3,400	750	600	600
Washington	19,500	3,200	2,400	3,000	450	600	2,700	650	475	500
West Virginia	10,200	1,400	1,400	1,800	225	425	1,100	300	250	250
Wisconsin	22,000	3,500	3,200	2,800	550	850	3,000	550	550	600
Wyoming	1,600	300	200	225	30	60	200	60	40	80
United States	1,130,000	180,000	156,000	168,000	30,300	45,500	132,000	32,000	28,300	28,200
Puerto Rico	8,300	1,100	1,000	650	450	425	1,100	60	200	250

*Does not include carcinoma in situ or basal and squamous cell skin cancers.

These estimates are offered as a rough guide and should not be regarded as definitive. They are calculated according to the distribution of estimated 1992 cancer deaths by state.

ESTIMATED CANCER DEATHS, BY STATE—1992

	ALL SITES		SELECTED SITES								
STATE	Number of Deaths	Death Rate per 100,000 Population*	Female Breast	Colon & Rectum	Lung	Oral	Uterus	Prostate	Skin Melanoma	Pancreas	Leukemia
Alabama	9,300	179	700	850	2,800	175	200	600	100	450	300
Alaska	500	184	50	50	200	10	10	25	10	30	25
Arizona	7,400	155	600	750	2,200	75	125	500	100	325	275
Arkansas	5,900	169	425	600	2,000	70	100	375	70	300	225
California	52,000	167	4,500	5,500	14,200	800	1,000	3,400	800	2,700	2,000
Colorado	4,900	145	475	550	1,200	80	75	350	90	250	175
Connecticut	7,300	172	700	900	1,900	125	100	400	90	400	225
Delaware	1,600	191	175	175	425	30	30	100	25	60	50
Dist. of Columbia	1,700	223	150	200	425	50	60	150	20	70	60
Florida	35,000	163	2,900	4,000	10,500	650	600	2,600	475	1,700	1,100
Georgia	12,200	175	1,100	1,200	3,600	250	225	850	175	550	400
Hawaii	1,700	138	125	225	450	30	30	100	20	90	50
Idaho	1,700	149	125	200	425	30	50	150	30	100	70
Illinois	24,300	176	2,200	3,000	6,700	325	500	1,500	250	1,200	800
Indiana	12,200	178	1,100	1,300	3,700	150	225	750	150	550	425
Iowa	6,200	159	600	800	1,700	100	100	475	90	300	225
Kansas	5,100	153	450	650	1,400	70	100	350	70	250	225
Kentucky	8,300	183	650	900	2,900	100	175	450	100	350	225
Louisiana	9,000	187	650	900	2,700	150	200	550	80	475	275
Maine	3,000	182	225	350	800	50	60	175	40	125	100
Maryland	9,900	192	900	1,100	2,900	150	150	600	125	500	325
Massachusetts	13,600	179	1,400	1,700	3,600	250	250	800	200	650	450
Michigan	18,700	176	1,700	2,000	5,200	300	400	1,300	175	900	700
Minnesota	8,500	156	800	1,000	2,000	100	150	650	100	500	350
Mississippi	5,700	172	425	600	1,700	90	125	375	60	300	200
Missouri	11,500	170	1,000	1,200	3,500	125	200	700	125	550	400
Montana	1,700	163	125	200	450	30	30	125	25	80	50
Nebraska	3,300	156	300	375	900	30	50	225	60	150	125
Nevada	2,400	189	200	225	850	30	40	125	30	125	75
New Hampshire	2,400	179	225	300	600	40	50	175	25	100	60
New Jersey	18,200	183	1,700	2,300	4,800	275	375	1,000	250	850	600
New Mexico	2,400	145	225	275	550	30	50	175	40	125	100
New York	40,000	176	4,000	5,100	10,000	700	850	2,500	500	2,000	1,300
North Carolina	14,000	169	1,300	1,500	4,200	225	275	1,000	225	700	450
North Dakota	1,300	154	100	150	325	25	25	125	20	70	70
Ohio	24,100	182	2,200	2,800	6,900	325	500	1,500	250	1,100	850
Oklahoma	6,800	167	550	700	2,100	125	175	400	100	300	250
Oregon	6,300	170	550	650	1,800	100	125	450	90	300	250
Pennsylvania	30,200	178	2,800	3,700	8,200	350	600	2,000	375	1,300	1,100
Rhode Island	2,500	181	250	300	650	60	50	150	25	100	75
South Carolina	6,800	172	550	700	2,000	150	125	475	90	325	250
South Dakota	1,500	152	150	175	375	20	25	125	20	70	60
Tennessee	10,900	174	900	1,200	3,500	150	225	650	125	500	375
Texas	28,000	159	2,200	2,600	7,800	425	500	1,600	350	1,300	1,100
Utah	1,900	125	200	200	300	20	50	175	40	100	80
Vermont	1,100	174	125	125	300	10	20	100	20	50	50
Virginia	12,200	180	1,100	1,300	3,600	175	225	850	150	550	375
Washington	9,100	166	800	900	2,600	100	100	700	125	425	325
West Virginia	4,700	179	350	550	1,500	60	100	300	60	200	150
Wisconsin	10,200	163	900	1,200	2,400	150	175	750	125	475	375
Wyoming	800	157	75	75	175	10	20	50	10	30	50
United States	520,000	171	46,000	58,300	146,000	7,950	10,000	34,000	6,700	25,000	18,200
Puerto Rico	4,100	130	300	400	600	150	125	375	25	175	175

*Average annual mortality rate for 1984–1988, adjusted to the age distribution of the 1970 US Census Population.

Selected Cancers

LUNG CANCER

Incidence: An estimated 168,000 new cases in 1992. The incidence rate, which had been increasing steadily in men and women for several decades, has declined in men, from a high of 86.6 per 100,000 in 1984 to 81.5 in 1988. The incidence rate in women continues to increase, to a high of 39.8 per 100,000 in 1988.

Mortality: An estimated 146,000 deaths in 1992. Since 1987, more women died of lung cancer than breast cancer which for over 40 years was the major cause of cancer death in women.

Warning Signals: Persistent cough, sputum streaked with blood, chest pain, recurring pneumonia or bronchitis.

Risk Factors: Cigarette smoking; exposure to certain industrial substances, such as arsenic, certain organic chemicals and asbestos, particularly for persons who smoke; radiation exposure from occupational, medical, and environmental sources. Residential radon exposure may increase risk, especially in cigarette smokers. Exposure to sidestream cigarette smoke increases the risk for nonsmokers.

Early Detection: Because symptoms often don't appear until the disease is in advanced stages, early detection is very difficult. In smokers who stop smoking at the time of early precancerous cellular changes, damaged bronchial lining tissues often return to normal. Smokers who persist in smoking may form abnormal cell growth patterns that lead to cancer. Chest x-ray, analysis of the types of cells contained in sputum, and fiberoptic examination of the bronchial passages assist diagnosis.

Treatment: Determined by the type and stage of the cancer. Options include surgery, radiation therapy, and chemotherapy. For many localized cancers, surgery is usually the treatment of choice. Because the disease has usually spread by the time it is discovered, radiation therapy and chemotherapy are often needed in combination with surgery. In small cell cancer, chemotherapy alone or combined with radiation has replaced surgery as the treatment of choice; on this regimen, a large percentage of patients experience remission, which in some cases is long-lasting.

Survival: The 5-year relative survival rate is only 13% in all patients, regardless of stage at diagnosis. The rate is 41% for cases detected when the disease is still localized, but only 18% of lung cancers are discovered that early.

COLON AND RECTUM CANCER

Incidence: An estimated 156,000 new cases in 1992, including 111,000 of colon cancer and 45,000 of rectum cancer.

Mortality: An estimated 58,300 deaths (51,000 from colon cancer; 7,300 from rectum cancer) in 1992.

Warning Signals: Rectal bleeding, blood in the stool, change in bowel habits.

Risk Factors: Personal or family history of cancer or polyps of the colon or rectum; inflammatory bowel disease. High-fat and/or low-fiber diet may be a significant causative factor.

Early Detection: Digital rectal examination, stool blood test, and proctosigmoidoscopy are recommended by the American Cancer Society to detect colon or rectum cancer in asymptomatic patients.

Digital rectal examination is performed by a physician during an office visit. The American Cancer Society recommends that this examination be performed annually after age 40.

The stool blood slide test is a simple method to test feces for hidden blood. The specimen is obtained by the patient at home and returned to the physician's office, a hospital, or a clinic for analysis. The Society recommends annual testing after age 50.

In proctosigmoidoscopy, the physician uses a hollow lighted tube to inspect the rectum and lower colon. The site of most colorectal cancers appears to be shifting higher in the colon; for this reason, longer, flexible instruments are being used, as well as a rigid scope. The American Cancer Society recommends the use of this examination every 3 to 5 years after age 50, on the advice of a physician.

If any of these tests reveal possible problems, more extensive studies, such as colonoscopy (examination of the entire colon) and barium enema (an x-ray procedure in which the intestines are viewed), may be needed.

Treatment: Surgery, at times combined with radiation, is the most effective method of treating colorectal cancer. The role of chemotherapy in treating advanced cases is under study. Combinations of chemotherapy and immunologic agents have recently been described as beneficial in postoperative patients with known positive lymph nodes.

Colostomy (creation of an abdominal opening for elimination of body wastes) is seldom needed for colon cancer patients and is infrequently required for rectal cancer patients. One study has shown that as few as 15% of patients whose rectal cancers are detected early require permanent colostomies. The American Cancer Society has a special patient assistance program for those who do have permanent colostomies (see p. 26).

Survival: When colorectal cancer is detected in an early, localized stage, the 5-year survival rates are 91% for colon cancer and 83% for rectal cancer. After the cancer has spread regionally, to involve adjacent organs or lymph nodes, the survival rates drop to 60% and 50%, respectively. Survival rates for persons with distant metastases are less than 7%.

CANCER INCIDENCE AND DEATHS BY SITE AND SEX—1992 ESTIMATES

CANCER INCIDENCE BY SITE AND SEX*

Men		Women	
PROSTATE	132,000	BREAST	180,000
LUNG	102,000	COLON & RECTUM	77,000
COLON & RECTUM	79,000	LUNG	66,000
BLADDER	38,500	UTERUS	45,500
LYMPHOMA	27,200	LYMPHOMA	21,200
ORAL	20,600	OVARY	21,000
MELANOMA OF THE SKIN	17,000	MELANOMA OF THE SKIN	15,000
KIDNEY	16,200	PANCREAS	14,400
LEUKEMIA	16,000	BLADDER	13,100
STOMACH	15,000	LEUKEMIA	12,200
PANCREAS	13,900	KIDNEY	10,300
LARYNX	10,000	ORAL	9,700
ALL SITES	565,000	ALL SITES	565,000

*Excluding nonmelanoma skin cancer and carcinoma in situ.

CANCER DEATHS BY SITE AND SEX

Men		Women	
LUNG	93,000	LUNG	53,000
PROSTATE	34,000	BREAST	46,000
COLON & RECTUM	28,900	COLON & RECTUM	29,400
PANCREAS	12,000	PANCREAS	13,000
LYMPHOMA	10,900	OVARY	13,000
LEUKEMIA	9,900	UTERUS	10,000
STOMACH	8,000	LYMPHOMA	10,000
ESOPHAGUS	7,500	LEUKEMIA	8,300
LIVER	6,600	LIVER	5,700
BRAIN	6,500	BRAIN	5,300
KIDNEY	6,400	STOMACH	5,300
BLADDER	6,300	MULTIPLE MYELOMA	4,500
ALL SITES	275,000	ALL SITES	245,000

BREAST CANCER

Incidence: An estimated 180,000 new cases among women in the United States during 1992. Approximately one of every 9 women will develop breast cancer during her lifetime. Breast cancer occurs rarely in men. Breast cancer incidence rates have increased about 3% a year since 1980, going from 84.8 per 100,000 in 1980 to 109.5 in 1988. Some of this increase is believed to be due to screening programs detecting tumors before they become clinically apparent. Other reasons for the increase are not fully understood.

Mortality: An estimated 46,300 deaths (46,000 women; 300 men) in 1992; in women, the second major cause of cancer death. Although incidence rates are increasing, early detection and improved treatment have kept mortality rates fairly stable over the past 50 years.

Warning Signals: Breast changes that persist, such as a lump, thickening, swelling, dimpling, skin irritation, distortion, retraction, scaliness, pain, or tenderness of the nipple.

Risk Factors: Over age 50; personal or family history of breast cancer; never had children; first childbirth after age 30.

Early Detection: The Society recommends a mammogram every year for asymptomatic women age 50 and over; women should have a screening mammogram by age 40; women 40 to 49 should have a mammogram every 1-2 years. In addition, a clinical physical examination of the breast is recommended every three years for women 20 to 40, and every year for those over 40. The Society also recommends monthly breast self-examination as a routine good health habit for women 20 years or older. Most breast lumps are not cancer, but only a physician can make a diagnosis.

Besides its effectiveness in screening asymptomatic women, mammography is recognized as a valuable diagnostic technique for women who do have findings suggestive of breast cancer. Once a breast lump is found, mammography can help determine if there are other lesions too small to be felt, in the same or opposite breast. All suspicious lumps should be biopsied for a definitive diagnosis, even when the mammography findings are described as normal.

Treatment: Taking into account the medical situation and the patient's preferences, treatment may require lumpectomy (local removal of the tumor), mastectomy (surgical removal of the breast), radiation therapy, chemotherapy, or hormone manipulation therapy. Often, two or more methods are used in combination.

Patients should discuss with their physicians possible options for the best management of their breast cancer.

New techniques in recent years have made breast reconstruction possible after mastectomy, and the cosmetic results are good. Reconstruction has become an important part of treatment and rehabilitation.

Survival: The 5-year survival rate for localized breast cancer has risen from 78% in the 1940s to 92% today. If the breast cancer is in situ (not invasive), the survival rate approaches 100%. If the cancer has spread regionally, however, the survival rate is 71%; for persons with distant metastases, the survival rate is 18%.

PROSTATE CANCER

Incidence: An estimated 132,000 new cases in the United States during 1992. Approximately one of every 11 men will develop prostate cancer. This is the second most common cancer in men, after skin cancer.

Mortality: An estimated 34,000 deaths in 1992, the second leading cause of cancer deaths in men.

Warning Signals: Weak or interrupted urine flow; inability to urinate, or difficulty starting or stopping the urine flow; the need to urinate frequently, especially at night; blood in the urine; pain or burning on urination; continuing pain in lower back, pelvis, or upper thighs. Most of these symptoms are nonspecific and may be similar to benign conditions such as infection or prostate enlargement.

Risk Factors: Incidence increases with age through the most advanced ages; over 80% of all prostate cancers are diagnosed in men over the age of 65. The disease is more common in northwestern Europe and North America. It is rare in the Near East, Africa, Central America, and South America. For reasons not currently known, black Americans have the highest incidence rate in the world. There is some familial association, but it is unclear whether this is due to genetic or environmental factors. Studies conducted internationally have shown that dietary fat may be a factor.

Early Detection: Every man 40 and over should have a rectal examination as part of his regular annual physical checkup. A new technique, transrectal ultrasound, may reveal cancers too small to be detected by physical examination. This new approach may be of special benefit to men who are at high risk. Men 40 and over should be alert to the signs and symptoms and should see their physician immediately if any occur. The key to saving lives is early detection.

Treatment: Surgery, alone or in combination with radiation and/or hormones, and anticancer drugs, are treatment options. Hormone treatment and anticancer drugs also may control prostate cancer for long periods by shrinking the size of the tumor, thus greatly relieving pain.

Survival: Sixty percent of all prostate cancers are discovered while still localized; the 5-year relative survival rate for patients whose tumors are diagnosed at this stage is 88%. Survival rates for all stages combined have steadily improved, and in the past 30 years have increased from 50% to 74%.

PANCREAS CANCER

Incidence: An estimated 28,300 new cases in the United States in 1992.

Mortality: An estimated 25,000 deaths in 1992. Pancreatic cancer is the fifth leading cancer killer. Pancreatic cancer incidence and mortality rates have been fairly stable since the early 1970s, except among black women whose rates have increased slightly.

Warning Signals: Cancer of the pancreas is a "silent" disease, one that occurs without symptoms until it is in advanced stages.

Risk Factors: Risk increases with age after age 50, with the most cases occurring between ages 65 and 79. Smoking is a major risk factor; incidence is more than twice as high for smokers versus nonsmokers. Sex and race are factors; the disease is 30% more common in men, and occurs approximately 60% more frequently in black Americans than in white Americans. Some studies have suggested associations with chronic pancreatitis, diabetes, or cirrhosis, but these findings have not been confirmed. In countries where the diet is high in fat, the pancreatic cancer rates are higher.

Early Detection: At present, only a biopsy yields a certain diagnosis, and because of the "silent" course of the disease, the need for biopsy is likely to be obvious only after the disease has advanced. Researchers are focusing on ways to diagnose pancreatic cancer before it is so far advanced that it presents symptoms. Ultrasound imaging and computerized tomography (CT) scans are being tried.

Prevention: Very little is known about what causes the disease or how to prevent it.

Treatment: Surgery, radiation therapy, and anticancer drugs are treatment options, but have had little influence on the outcome. Diagnosis is usually so late that none of these is used.

Survival: Only 3% of patients live more than 5 years after diagnosis. The 2% of patients whose cancers occur in the pancreas' insulin-producing cells, and not its duct cells, tend to live longer; approximately 30% of these patients live more than 3 years after diagnosis.

UTERUS AND CERVIX CANCER

Incidence: An estimated 45,500 new invasive cases in 1992, including 13,500 cases of cancer of the cervix and 32,000 cases of cancer of the corpus (body) of the uterus, usually of the endometrium (lining). The incidence of invasive cervical cancer has steadily decreased over the years. Cervical carcinoma in situ, a precancerous condition, is now more frequent than invasive cancer, especially in women over 50. Cervical cancer is most common today among women of low socioeconomic groups, but all women are at risk. Endometrial cancer is most common in mature women, and diagnosis usually is made after age 50.

Mortality: An estimated 4,400 deaths in 1992 from cervical cancer and 5,600 from endometrial cancer or unspecified uterine cancer. Overall, the death rate for uterine cancer has decreased more than 70% over the past 40 years, due mainly to the Pap test for early detection of cervical cancer and regular checkups.

Warning Signals: Bleeding outside of the normal menstrual period or after menopause, or unusual vaginal discharge.

Risk Factors: For cervical cancer: early age at first intercourse, multiple sex partners, cigarette smoking, and certain sexually transmitted diseases. For endometrial cancer: history of infertility, failure to ovulate, prolonged estrogen therapy, obesity.

Early Detection: The Pap test is a valuable simple procedure that can be performed at appropriate intervals by health care professionals as part of a pelvic examination. A small sample of cells is swabbed from the cervix and body of the uterus, transferred to a slide, and examined under a microscope. This test should be performed annually with a pelvic examination in women who are or have been sexually active or who have reached age 18 years. After three or more consecutive annual examinations with normal findings, the Pap test may be performed less frequently at the discretion of the physician.

The Pap test is highly effective in detecting early cancer of the uterine cervix; it is only partially effective in detecting endometrial cancer. Women at high risk of developing endometrial cancer should have an endometrial tissue sample evaluated at menopause.

During menopause, there is a decline in the level of hormones (estrogens) normally produced by the ovaries. This causes symptoms such as "hot flashes" or thinning of the vaginal lining (the latter can make sexual intercourse painful). To control these symptoms, estrogen replacement therapy is given to women during and after menopause. This therapy increases the risk of endometrial cancer, therefore, the benefits and risks of such treatment should be carefully discussed by the woman and her physician.

Treatment: Uterine cancers generally are treated by surgery or radiation, or by a combination of the two. In precancerous (in situ) stages, changes in the cervix may be treated by cryotherapy (the destruction of cells by extreme cold), by electrocoagulation (the destruction of tissue through intense heat by electric current), or by local surgery. Precancerous endometrial changes may be treated with the hormone progesterone.

Survival: The 5-year survival rate for all cervical cancer patients is 66%. For patients diagnosed early, however, the survival rate is 88%, and if the disease is in situ, the rate is virtually 100%. In endometrial cancer, survival rates are 83% overall, 93% if discovered at an early stage, and virtually 100% if discovered at the precancerous lesion stage.

CANCER IN CHILDREN

Incidence: An estimated 7,800 new cases in 1992; as a childhood disease, cancer is rare. Common sites include the blood and bone marrow, bone, lymph nodes, brain, nervous system, kidneys, and soft tissues.

Mortality: An estimated 1,500 deaths in 1992, about one-third of them from leukemia. Despite its rarity, cancer is the chief cause of death by disease in children between the ages of 1 and 14. Mortality has declined from 8.3 per 100,000 in 1950 to 3.3 in 1988.

Early Detection: Cancers in children often are difficult to recognize. Parents should see that their children have regular medical checkups and be alert to any unusual symptoms that persist. These include: unusual mass or swelling; unexplained paleness and loss of energy; sudden tendency to bruise; persistent, localized pain or limping; prolonged, unexplained fever or illness; frequent headaches, often with vomiting; sudden eye or vision changes; and excessive, rapid weight loss.

Some of the main childhood cancers are:

Leukemia, p. 12.

Osteogenic Sarcoma and *Ewing's Sarcoma* are bone cancers. These may cause no pain at first, but swelling in the area of the tumor is often a first sign.

Neuroblastoma can appear anywhere but usually in the abdomen, where a swelling occurs.

Rhabdomyosarcoma, the most common soft tissue sarcoma, can occur in the head and neck area, genitourinary area, trunk, and extremities.

Brain cancers in early stages may cause headaches, blurred or double vision, dizziness, difficulty in walking or handling objects, and nausea.

Lymphomas and *Hodgkin's Disease* are cancers that involve the lymph nodes, and also may invade bone marrow and other organs. They may cause swelling of lymph nodes in the neck, armpit, or groin. Other symptoms may include general weakness and possibly fever.

Retinoblastoma, an eye cancer, usually occurs in children under the age of four. When detected early, cure is possible with appropriate treatment.

Wilms' tumor, a kidney cancer, may be recognized by a swelling or lump in the abdomen.

Treatment: Childhood cancers can be treated by a combination of therapies. Treatment is coordinated by a team of experts including oncologic physicians, pediatric nurses, social workers, psychologists, and

others who assist children and their families.

Survival: Five-year survival rates vary considerably, depending on the site. Among those for white children: all sites 67%; bone cancer, 56%; neuroblastoma, 55%; brain and central nervous system, 58%; Wilms' tumor (kidney), 84%; and Hodgkin's disease, 87%. (Data are not available for other ethnic groups.)

LEUKEMIA

Incidence: An estimated 28,200 new cases in 1992, approximately evenly divided into acute leukemia and chronic leukemia. Although it is often thought of as primarily a childhood disease, leukemia will strike many more adults (25,700 this year) than children (2,500 this year). Acute lymphocytic leukemia accounts for approximately 1,900 of the cases of leukemia among children. In adults, the most common types are acute granulocytic (approximately 6,500 cases annually) and chronic lymphocytic (8,200 cases annually).

Mortality: An estimated 18,200 deaths in 1992.

Warning Signals: Early signs may include fatigue, paleness, weight loss, repeated infections, bruising easily, and nosebleeds or other hemorrhages. In children, these symptoms can appear suddenly. Chronic leukemia can progress slowly and with few symptoms.

Risk Factors: Leukemia strikes both sexes and all ages. Causes of most cases are unknown. Persons with Down Syndrome and certain other genetic abnormalities have higher than normal incidence of leukemia. It has also been linked to excessive exposure to ionizing radiation and to certain chemicals such as benzene, a toxic, commercially used substance that is also present in lead-free gasoline. Certain forms of leukemia and lymphoma are caused by a retrovirus, HTLV-1.

Early Detection: Because symptoms often appear to be those of other, less serious conditions, leukemia can be difficult to diagnose early. When a physician does suspect leukemia, diagnosis can be made using blood tests and biopsy of the bone marrow.

Treatment: Leukemia is a cancer of the bloodforming tissues. When leukemia occurs, millions of abnormal, immature white blood cells are released into the circulatory system. These abnormal cells crowd out normal white cells (which fight infection), platelets (which control hemorrhaging), and red blood cells (which prevent anemia). Chemotherapy, the most effective method of treating leukemia, kills the attacking abnormal cells. Transfusions of blood components and antibiotics are used as supportive treatments. Today, continuing research at leading US medical centers is yielding new and better drugs for treating leukemia patients. Various anticancer drugs are used, either in combinations or as single agents. To prevent persistence of hidden cells, therapy of the central nervous system has become standard treatment, especially in acute lymphocytic leukemia. Under appropriate conditions, bone marrow transplantation may be useful in the treatment of certain leukemias.

Survival: The 5-year survival rate for patients with leukemia is 35%, due partly to very poor survival of patients with some types of leukemia such as acute granulocytic. Over the last 30 years, however, there has been a dramatic improvement in survival of patients with acute lymphocytic leukemia: from a 5-year survival rate of 4% for people diagnosed in the early 1960s to 28% in the early 1970s to 50% around 1980. In children, the improvement has been from 4% to 73%.

SKIN CANCER

Incidence: Over 600,000 cases a year, the vast majority of which are highly curable basal cell or squamous cell cancers. They are more common among individuals with lightly pigmented skin who live at latitudes near the equator. The most serious skin cancer is melanoma, which will be diagnosed in about 32,000 persons in 1992. Since 1973, the incidence rate of melanoma has increased about 4% per year.

Mortality: An estimated 8,800 deaths this year, 6,700 from malignant melanoma and 2,100 due to other skin cancers.

Warning Signals: Any unusual skin condition, especially a change in the size or color of a mole or other darkly pigmented growth or spot. Scaliness, oozing, bleeding, or change in the appearance of a bump or nodule, the spread of pigmentation beyond its border, a change in sensation, itchiness, tenderness, or pain are all warning signs of melanoma.

Risk Factors: Excessive exposure to the sun; fair complexion; occupational exposure to coal tar, pitch, creosote, arsenic compounds, or radium. Among blacks, because of heavy skin pigmentation, skin cancer incidence is very low.

Prevention: The sun's ultraviolet rays are strongest between 10 a.m. and 3 p.m. Exposure at these times should be avoided, and protective clothing should be worn. Sunscreens should be used. These come in various strengths, ranging from those facilitating gradual tanning to those that allow practically no tanning. Because of the possible link between severe sunburns in childhood and greatly increased risk of melanoma in later life, children, in particular, should be protected from traumatic sunburns.

Early Detection: Early detection is critical. Recognition of changes in skin growths or the appearance of new growths is the best way to find early skin cancer. Adults should practice skin self-examination once a month, and suspicious lesions should be evaluated promptly by a physician. Basal and squamous cell skin cancers often take the form of a pale, waxlike, pearly

nodule, or a red, scaly, sharply outlined patch. A sudden or progressive change in a mole's appearance should be checked by a physician. Melanomas often start as small, mole-like growths that increase in size, change color, become ulcerated, and bleed easily from a slight injury. A simple **ABCD** rule outlines the warning signals of melanoma: **A is for asymmetry**. One half of the mole does not match the other half. **B is for border irregularity**. The edges are ragged, notched, or blurred. **C is for color**. The pigmentation is not uniform. **D is for diameter greater than 6 millimeters**. Any sudden or progressive increase in size should be of special concern.

Treatment: There are four methods of treatment: surgery (used in 90% of cases), radiation therapy, electrodessication (tissue destruction by heat), or cryosurgery (tissue destruction by freezing) for early skin cancer. For malignant melanoma, the primary growth must be adequately excised, and it may be necessary to remove nearby lymph nodes. Removal and microscopic examination of all suspicious moles is essential. Advanced cases of melanoma are treated according to the characteristics of the case.

Survival: For basal cell or squamous cell cancers, cure is highly likely if detected and treated early. Malignant melanoma can spread to other parts of the body quickly; however, when detected in its earliest stages, and with proper treatment, it is highly curable.

The overall 5-year survival rate for white patients with malignant melanoma is 82%. The 5-year survival rate for localized malignant melanoma is 90%; survival rates for regional and distant disease are 50% and 14%, respectively. About 80% of melanomas are diagnosed in a local stage.

FIVE-YEAR SURVIVAL RATES* FOR SELECTED SITES

Selected Site	All Stages %	Local %	Regional %	Distant %
Oral	51	75	41	18
Colon-Rectum	56	88	57	6
Pancreas	3	7	4	1
Lung	13	41	14	2
Melanoma	81	91	50	14
Female Breast	77	92	71	18
Cervix Uteri	66	88	52	14
Corpus Uteri	83	93	70	27
Ovary	39	87	39	19
Prostate	74	88	79	29
Bladder	78	90	45	9
Kidney	53	84	55	8

*Adjusted for normal life expectancy. This chart is based on cases diagnosed in 1981–1987.
Source: Cancer Statistics Branch, National Cancer Institute

OVARY CANCER

Incidence: An estimated 21,000 new cases in the United States in 1992. It is estimated that one of every 70 women will develop ovarian cancer during her lifetime. It accounts for 4% of all cancers among women.

Mortality: An estimated 13,000 deaths in 1992. Although ovarian cancer ranks second in incidence among gynecological cancers, it causes more deaths than any other cancer of the female reproductive system.

Warning Signals: Ovarian cancer is often "silent," showing no obvious signs or symptoms until late in its development. The most common sign is enlargement of the abdomen, which is caused by the accumulation of fluid. Rarely will there be abnormal vaginal bleeding. In women over 40, vague digestive disturbances (stomach discomfort, gas, distention) that persist and cannot be explained by any other cause may indicate the need for a thorough evaluation for ovarian cancer.

Risk Factors: Risk for ovarian cancer increases with age. The highest rates are for women over 60. Women who have never had children are twice as likely to

develop ovarian cancer as those who have. Early age of first pregnancy, early menopause, and the use of oral contraceptives, which reduces the frequency of ovulation, appear to be protective against ovarian cancer. If a woman has had breast cancer, her chances of developing ovarian cancer double. Certain rare genetic disorders are associated with increased risk. With the exception of Japan, the highest incidence rates are reported from the more industrialized countries.

Early Detection: Periodic, thorough pelvic examinations are important. *The Pap test, useful in detecting cervical cancer, does not reveal ovarian cancer.* Women over the age of 40 should have a cancer-related checkup every year.

Treatment: Surgery, radiation therapy, and drug therapy are treatment options. Surgical treatment usually includes the removal of one or both ovaries (oophorectomy), the uterus (hysterectomy), and the fallopian tubes (salpingectomy). In some very early tumors, it is possible that only the involved ovary will be removed, especially in young women. In advanced disease, an attempt is made to remove all intraabdominal disease, to enhance the effect of chemotherapy.

Survival: Overall, the 5-year survival rate for ovarian cancer is 39%. If diagnosed and treated early, the relative survival rate is 87%; however, only about 23% of all cases are detected at the localized stage. Survival rates for women with regional and distant disease are 39% and 19%, respectively. Modern chemotherapeutic agents have improved the survival rate.

BLADDER CANCER

Incidence: An estimated 51,600 new cases of bladder cancer in 1992; 38,500 in men, 13,100 in women. Bladder cancers account for 7% of the new cancer cases diagnosed each year in men and 2% in women. Bladder cancer is the fourth most common form of cancer in men and the ninth most common form of cancer in women in this country.

Mortality: An estimated 9,500 deaths in 1992 from bladder cancers.

Warning Signals: Blood in the urine. Usually associated with increased frequency of urination.

Risk Factors: Smoking is the greatest risk factor in bladder cancer, with smokers experiencing twice the risk of nonsmokers. Smoking is estimated to be responsible for approximately 47% of the bladder cancer deaths among men and 37% among women. Overall, the incidence rate of bladder cancer is four times greater among men than among women, and is higher in whites than in blacks. People living in urban areas and workers exposed to dye, rubber, or leather also are at higher risk.

Diagnosis: Bladder cancer is diagnosed by examination of the bladder wall with a cystoscope, a slender tube fitted with a lens and light that can be inserted into the tract through the urethra.

Treatment: Surgery, alone or in combination with other treatments is used in over 90% of cases. Preoperative chemotherapy alone or with radiation before cystectomy (bladder removal) has improved some treatment results.

Survival: When detected at an early stage, the 5-year survival rate for bladder cancer is 90%. For regional and distant disease the survival rates are 45% and 9%, respectively.

ORAL CANCER

Incidence: An estimated 30,300 new cases in 1992. Incidence is more than twice as high in men as in women, and is most frequent in men over age 40.

Mortality: An estimated 7,950 deaths in 1992.

Warning Signals: A sore that bleeds easily and doesn't heal; a lump or thickening; a red or white patch that persists. Difficulty in chewing, swallowing, or moving tongue or jaws are often late changes.

Risk Factors: Cigarette, cigar, or pipe smoking; use of smokeless tobacco; excess use of alcohol.

Early Detection: Cancer can affect any part of the oral cavity, including the lip, tongue, mouth, and throat. Dentists and primary care physicians have the opportunity, during regular checkups, to see abnormal tissue changes and to detect cancer at an early, curable stage.

Treatment: Principal methods are radiation therapy and surgery. Chemotherapy is being studied as an adjunct to surgery in advanced disease.

Survival: Five-year survival rates vary substantially, depending on the site. Rates range from 26% for cancer of the hypopharynx to 92% for lip cancer. Overall, 5-year survival for oral cancer patients is about 51%.

TRENDS IN SURVIVAL BY SITE OF CANCER, BY RACE
Cases Diagnosed in 1960–63, 1970–73, 1974–76, 1977–80, 1981–87

SITE	WHITE					BLACK				
	RELATIVE 5-YEAR SURVIVAL					RELATIVE 5-YEAR SURVIVAL				
	1960-63[1]	1970-73[1]	1974-76[2]	1977-80[2]	1981-87[2]	1960-63[1]	1970-73[1]	1974-76[2]	1977-80[2]	1981-87[2]
All sites	39	43	50	51	53*	27	31	39	39	38
Oral cavity & pharynx	45	43	55	54	54	–	–	35	34	31
Esophagus	4	4	5	6	9*	1	4	4	4	6*
Stomach	11	13	14	16	16*	8	13	16	16	17
Colon	43	49	50	53	58*	34	37	46	48	47
Rectum	38	45	49	51	55*	27	30	41	37	44
Liver	2	3	4	3	5	–	–	1	3	5
Pancreas	1	2	3	2	3*	1	2	2	5	4
Larynx	53	62	66	67	68	–	–	59	58	54
Lung & bronchus	8	10	12	13	13*	5	7	11	12	11
Melanoma of skin	60	68	80	82	82*	–	–	69†	51‡	70
Breast (female)	63	68	75	75	78*	46	51	63	63	63
Cervix uteri	58	64	69	68	68	47	61	63	62	57
Corpus uteri	73	81	89	86	84*	31	44	62	56	56
Ovary	32	36	36	38	39*	32	32	41	40	36
Prostate gland	50	63	67	72	76*	35	55	58	62	63*
Testis	63	72	79	88	93*	–	–	77†	73†	94
Urinary bladder	53	61	74	76	79*	24	36	48	55	59*
Kidney & renal pelvis	37	46	52	51	53	38	44	49	57	52
Brain & nervous system	18	20	22	24	24*	19	19	27	28	33
Thyroid gland	83	86	92	92	94	–	–	87	92	94
Hodgkin's disease	40	67	71	73	77*	–	–	68	73	74
Non-Hodgkin's lymphoma	31	41	47	49	51*	–	–	48	49	45
Multiple myeloma	12	19	24	25	26*	–	–	27	32	28
Leukemia	14	22	34	36	36*	–	–	31	30	29

Source: Cancer Statistics Branch, National Cancer Institute.

[1] Rates are based on End Results Group data from a series of hospital registries and one population-based registry.

[2] Rates are from the SEER Program. They are based on data from population-based registries in Connecticut, New Mexico, Utah, Iowa, Hawaii, Atlanta, Detroit, Seattle-Puget Sound and San Francisco-Oakland. Rates are based on follow-up of patients through 1988.

* The difference in rates between 1974-76 and 1981-87 is statistically significant ($p < 0.05$).

† The standard error of the survival rate is between 5 and 10 percentage points.

‡ The standard error of the survival rate is greater than 10 percentage points.

– Valid survival rate could not be calculated.

HOW TO ESTIMATE CANCER STATISTICS LOCALLY

Community Population	Estimated No. Who Are Alive, Saved from Cancer	Estimated No. Cancer Cases Under Medical Care in 1992	Estimated No. Who Will Die of Cancer in 1992	Estimated No. of New Cases in 1992	Estimated No. Who Will Be Saved from Cancer in 1992	Estimated No. Who Will Eventually Develop Cancer	Estimated No. Who Will Die of Cancer if Present Rates Continue
1,000	13	16	2	4	2	300	220
2,000	26	32	4	8	4	600	440
3,000	39	48	6	12	6	900	660
4,000	52	64	8	16	8	1,200	880
5,000	65	80	10	20	10	1,500	1,100
10,000	130	160	20	40	20	3,000	2,200
25,000	325	400	50	100	50	7,500	5,500
50,000	650	800	100	200	100	15,000	11,000
100,000	1,300	1,600	200	400	200	30,000	22,000
200,000	2,600	3,200	400	800	400	60,000	44,000
500,000	6,500	8,000	1,000	2,000	1,000	150,000	110,000

NOTE: The figures are only a rough approximation of actual data for a community and should be used with caution. It is suggested that every effort be made to obtain actual data from a cancer registry source. Numbers may vary according to the age distribution of the local population.

Cancer in Minorities

In 1992, about 1,130,000 cancers will be diagnosed in the United States. About 115,000 of these cancers will be among black Americans and 32,000 among other minority Americans.

Cancer incidence and mortality rates are generally higher for black Americans than for whites. In 1988, the incidence rates were 402 per 100,000 for blacks and 376 for whites, about a 7% difference. In 1988, the mortality rates were 213 for blacks and 169 for whites.

Cancer sites where blacks have significantly higher incidence and mortality rates include esophagus, uterine cervix, stomach, liver, prostate, larynx, and multiple myeloma. Rates for esophageal cancer are over three times higher among blacks than whites.

The five-year survival rate for cancer in blacks diagnosed from 1981 through 1987 was about 38% compared with 53% for whites. A considerable part of this difference in survival can be attributed to late diagnoses. Many cancers are more frequently diagnosed in a localized stage among whites than among blacks. Most of these sites represent cancers for which screening tests are available or which present symptoms early in the disease process. Early detection and timely treatment can increase survival and halt the disease progression.

Incidence and mortality rates for other minority groups such as Hispanics are lower than those for white or black Americans. Because cancer risk is strongly associated with lifestyle and behavior, differences in ethnic and cultural groups can provide clues to factors involved in the development of cancer such as dietary patterns, alcohol use, and sexual and reproductive behaviors. Cultural values and belief systems can affect attitudes about seeking medical care or following screening guidelines (see p. 18). Socioeconomic factors such as lack of health insurance or means of transportation can impede access to care, leading to late diagnosis and poorer survival.

NUMBER OF CANCER DEATHS FOR BLACK, AMERICAN INDIAN, CHINESE, JAPANESE, AND HISPANIC PERSONS, UNITED STATES, 1988

Cancer Site	Black Males	Black Females	American Indian	Chinese	Japanese	Hispanic*
All sites	30,321	23,647	1,151	1,388	1,012	9,602
Oral cavity	939	303	28	53	9	167
Esophagus	1,580	470	22	24	23	164
Stomach	1,316	802	48	98	130	582
Colon & rectum	2,637	3,014	102	159	153	866
Liver & other biliary	720	564	71	151	60	565
Pancreas	1,355	1,469	55	83	85	585
Lung (male)	10,112	–	197	211	127	1,218
Lung (female)	–	4,019	111	102	64	535
Breast (female)	–	4,467	66	99	62	798
Cervix uteri	–	974	29	21	8	240
Other uterus	–	953	30	31	32	231
Ovary	–	888	11	16	10	110
Prostate	4,582	–	64	26	43	482
Bladder	411	371	13	18	14	132
Kidney	501	319	30	18	19	241
Brain & CNS	358	311	22	23	14	248
Lymphomas	684	513	35	49	36	477
Leukemia	806	672	49	38	28	464
Multiple myeloma	631	716	20	15	12	179

*Persons classified as of Hispanic origin on death certificates may be of any race. Hispanic deaths are only reported for the District of Columbia and the following 26 states: Alabama, Arizona, Arkansas, California, Colorado, Georgia, Hawaii, Illinois, Indiana, Kansas, Kentucky, Maine, Mississippi, Montana, Nebraska, New Jersey, New York (including New York City), North Carolina, North Dakota, Ohio, Oregon, Rhode Island, Texas, Utah, Washington, and Wyoming). In 1980, these reporting areas accounted for about 80% of the Hispanic population in the United States. Caution should be exercised in generalizing this mortality data to the entire US Hispanic population.

Prevention

	AVOID THOSE FACTORS THAT MIGHT LEAD TO THE DEVELOPMENT OF CANCER. (PRIMARY PREVENTION)
SMOKING	Cigarette smoking is responsible for 90% of lung cancer cases among men and 79% among women—about 87% overall. Smoking accounts for about 30% of all cancer deaths. Those who smoke two or more packs of cigarettes a day have lung cancer mortality rates 15 to 25 times greater than nonsmokers. (See Tobacco Use)
SUNLIGHT	Almost all of the more than 600,000 cases of basal and squamous cell skin cancer diagnosed each year in the US are considered to be sun-related. Epidemiologic evidence shows that sun exposure is a major factor in the development of melanoma and that the incidence increases for those living near the equator. (See Selected Cancers: Skin Cancer)
IONIZING RADIATION	Excessive exposure to ionizing radiation can increase cancer risk. Most medical and dental x-rays are adjusted to deliver the lowest dose possible without sacrificing image quality. Excessive radon exposure in homes may increase risk of lung cancer, especially in cigarette smokers. If levels are found to be too high, remedial actions should be taken.
NUTRITION AND DIET	Risk for colon, breast, and uterine cancers increases in obese people. High-fat diets may contribute to the development of cancers of the breast, colon, and prostate. High-fiber foods might help reduce risk of colon cancer. A varied diet containing plenty of vegetables and fruits rich in vitamins A and C may reduce risk for a wide range of cancers. Salt-cured, smoked, and nitrite-cured foods have been linked to esophagus and stomach cancer. (See Nutrition and Cancer)
ALCOHOL	Oral cancer and cancers of the larynx, throat, esophagus, and liver occur more frequently among heavy drinkers of alcohol especially when accompanied by cigarette smoking or chewing tobacco. (See Selected Cancers: Oral Cancer)
SMOKELESS TOBACCO	Use of chewing tobacco or snuff increases risk of cancer of the mouth, larynx, throat, and esophagus and is a highly addictive habit. (See Selected Cancers: Lung Cancer and Oral Cancer)
ESTROGEN	Estrogen treatment to control menopausal symptoms increases risk of endometrial cancer. However, including progesterone in estrogen replacement therapy helps to minimize this risk. Consultation with a physician will help each woman to assess personal risks and benefits. (See Selected Cancers: Uterus and Cervix Cancer)
OCCUPATIONAL HAZARDS	Exposure to several different industrial agents (nickel, chromate, asbestos, vinyl chloride, etc.) increases risk of various cancers. Risk from asbestos is greatly increased when combined with cigarette smoking. (See Cancer and the Environment)
	ACTIONS TO DIAGNOSE A CANCER OR PRECURSOR AS EARLY AS POSSIBLE (SECONDARY PREVENTION/EARLY DETECTION).
BREAST CANCER DETECTION	The American Cancer Society recommends that screening mammography begin by age 40. Women age 40–49 should have mammography every 1-2 years, depending on physical and mammographic findings. Women age 50 and older should have mammograms yearly. The ACS recommends the monthly practice of breast self-exam (BSE) by women 20 years and older as a routine good health habit. Clinical examination of the breast should be done every three years from ages 20-40 and then every year. (See Selected Cancers: Breast)
COLORECTAL	The American Cancer Society recommends three tests for the early detection of colon and rectum cancer in people without symptoms. A digital rectal examination by a physician during an office visit, should be performed every year after the age of 40; the stool blood test is recommended every year after 50; and the proctosigmoidoscopy examination should be carried out every 3 to 5 years, based on the advice of a physician. (See Selected Cancers: Colon and Rectum)
PAP TEST	For cervical cancer, women who are or have been sexually active, or have reached age 18, should have an annual Pap test and pelvic examination. After a woman has had three or more consecutive satisfactory normal annual examinations, the Pap test may be performed less frequently at the discretion of her physician. (See Selected Cancers: Uterus and Cervix)

CANCER-RELATED CHECKUP GUIDELINES

Guidelines for the early detection of cancer in people without symptoms are recommended by the American Cancer Society as follows. A cancer-related checkup by a physician every three years for persons age 20-39 and annually for those age 40 and over. Some persons at particular risk for certain cancers may need tests more often and should discuss this with their doctor. The checkup should always include health counseling (how to quit smoking, etc.) and exams for cancer of the breast, uterus, cervix, colon/rectum, prostate, mouth, skin, testes, thyroid, and lymph nodes.

In particular:

• Ages 20-40—For **breast cancer,** an examination by a physician every three years, a self-exam every month, and a screening mammogram by age 40. For **cervical cancer,** women who are or have been sexually active, or have reached age 18, should have an annual Pap test and pelvic examination. After a woman has had three or more consecutive satisfactory normal annual examinations, the Pap test may be performed less frequently at the discretion of her physician.

• Ages 40 and over—For **breast cancer,** a professional exam every year, a self-exam every month, and a mammogram every 1-2 years for those 40-49; every year for those 50 and over. For **cervical cancer,** women who are or have been sexually active, or have reached age 18 years, should have an annual Pap test and pelvic examination. After a woman has had three or more consecutive satisfactory normal annual examinations, the Pap test may be performed less frequently at the discretion of her physician. For women at high risk, an endometrial tissue sample should be taken at menopause. For **colon and rectum cancer,** a digital rectal exam every year after 40, a stool blood test every year after 50, and a sigmoidoscopic exam every 3-5 years, based on the advice of a physician.

TOBACCO USE

Smoking is the most preventable cause of death in our society. Tobacco use is responsible for more than one in six deaths in the United States. Based upon data from the American Cancer Society's Cancer Prevention Study II (CPS II), it is estimated that smoking is related to over 400,000 U.S. deaths each year. According to the World Health Organization, approximately 2.5 million people die worldwide each year as a result of smoking.

The American Cancer Society estimates that cigarette smoking is responsible for 90% of lung cancer deaths among men and 79% among women—87% overall. This reflects the fact, that in the past, more men than women smoked and smoked more heavily. However, the gap between the numbers of men and women smoking has been narrowing.

Smoking is also associated with cancers of the mouth, pharynx, larynx, esophagus, pancreas, uterine cervix, kidney, and bladder. Smoking accounts for 30% of all cancer deaths, is a major cause of heart disease, and is associated with conditions ranging from colds and gastric ulcers to chronic bronchitis, emphysema, and cerebrovascular disease.

A Decline in Smoking

The 1989 Surgeon General's Report, which covered the 25 years of progress since the first Surgeon General's Report on Smoking and Health in 1964, reported that the prevalence of smoking has decreased from 40% in 1965 to 29% in 1987. Between 1964 and 1985, approximately three-quarters of a million smoking-related deaths were avoided or postponed as a result of decisions to quit smoking or not to start.

It is now estimated that in the United States today there are about 50 million cigarette smokers. From 1976 to 1987, smoking among males (20 years and older) dropped from 42% of the population to 32%, while smoking among women decreased from 32% to 27%. Smoking rates are higher among blacks, blue-collar workers, and people with fewer years of education. While smoking rates declined about 50% for college graduates and 20% for high school graduates from 1966 to 1987, smoking prevalence remained about the same for people who did not complete high school.

Approximately half of smokers start smoking regularly before 18 years of age. Young people (especially girls) are starting to smoke at earlier ages. According to the 1990 Youth Risk Behavior Survey conducted by the Centers for Disease Control, 36% of all students in grades 9-12 reported using some form of tobacco within a one month time period. About 13% of high school students reported smoking almost daily. More than 3,000 teenagers become regular smokers each day in the United States.

A 1985 report by the US Congress Office of Technology Assessment estimates the cost of smoking to the economy to be about $65 billion. This figure accounts for costs of treating smoking-related diseases and lost productivity amounting to $2.17 for each pack of cigarettes sold.

Higher cigarette prices, health concerns, smoking restrictions, and declining social acceptance of smoking have resulted in per capita cigarette consumption falling over 30%—from 4,148 in 1973 to 2,817 in 1990. This is the lowest per capita consumption since 1942.

A September 1991 tobacco report of the US Department of Agriculture estimates US cigarette output from July 1990 to June 1991 at 730 billion, up 7% from the previous year. Although consumption has declined in this country, U.S. cigarette exports have increased about 180% since 1985, a direct result of US trade policy and aggressive marketing by tobacco manufacturers. In Japan, US cigarette exports have increased over 600%—from 6.5 billion in 1985 to 47.5 billion in 1990. American pressure forced the South Korean government to open its cigarette market in 1986. Since that time, exports to South Korea have increased from 0.3 billion in 1987 to 3.4 billion in 1990.

Nicotine Addiction

Tobacco smoke contains over 4,000 chemical compounds including at least 43 different carcinogenic substances. One compound found in substantial amounts in tobacco products is nicotine. Nicotine is absorbed readily from tobacco smoke in the lungs and from smokeless tobacco in the mouth or nose and is rapidly distributed throughout the body. The Surgeon General's Report in 1988 concluded 1) cigarettes and other forms of tobacco are addicting; 2) nicotine is the drug in tobacco that causes addiction, and 3) the pharmacologic and behavioral processes that determine tobacco addiction are similar to those that determine addiction to drugs such as heroin and cocaine.

Smoking Cessation

In September 1990, the Surgeon General released a report showing that people who quit smoking, regardless of age, live longer than people who continue to smoke. Smokers who quit before age 50 have one-half the risk of dying in the next 15 years compared with those who continue to smoke.

By 1987, more than 38 million Americans had quit smoking cigarettes, nearly half of all living adults who ever smoked. According to a 1989 Gallup survey, 57% of smokers 50 and older, 68% of smokers aged 18-29, and 67% of smokers aged 30-49 want to quit smoking.

The report states that "smoking cessation has major and immediate health benefits for men and women of all ages." Quitting smoking substantially decreases risks of lung, laryngeal, esophageal, oral, pancreatic, bladder, and cervical cancer. The benefits of cessation include risk reduction for other major diseases including coronary heart disease and cardiovascular disease.

Involuntary Smoking Hazards

People who do not smoke themselves, but who are exposed to the tobacco smoke of others are at increased risk for certain diseases. Environmental tobacco smoke (ETS) causes an estimated 53,000 deaths annually in the United States, about two-thirds from heart disease and about 4,000 from lung cancer. Passive smoking can result in aggravated asthmatic conditions and impaired blood circulation.

Passive smoking poses additional health hazards for unborn and young children. Children exposed to secondhand smoke have increased risks of respiratory illnesses and infections, impaired development of lung function, and middle ear infections. Infants born to women who smoked during pregnancy are more likely to die from Sudden Infant Death Syndrome. The American Academy of Pediatrics estimates that 9 million American children under the age of 5 may be exposed to ETS.

Undiluted sidestream smoke has significantly higher concentrations of the toxic and carcinogenic compounds found in mainstream smoke, including nitrosamines, ammonia, and nicotine. The EPA's Science Advisory Board, in reviewing evidence that ETS causes excess lung cancer in adults and respiratory illness in children, has recommended that ETS be classified as a Class A (known human) carcinogen.

Smokeless Tobacco

There has been a resurgence in the use of all forms of smokeless tobacco—plug, leaf, and snuff—but the greatest cause for concern centers on the increased use of "dipping snuff." In this practice, tobacco that has been processed into a coarse, moist powder is placed between the cheek and gum, and nicotine, along with a number of other carcinogens, is absorbed through the oral tissue. "Dipping snuff" is a highly addictive habit, one that exposes the body to levels of nicotine equal to those of cigarettes. A 1986 report of the Advisory Committee to the Surgeon General, outlining the health consequences of smokeless tobacco use, concluded that there is strong scientific evidence that the use of snuff causes cancer in humans, particularly cancer of the oral cavity. Oral cancer occurs several times more frequently among snuff dippers compared with non-tobacco users, and the excess risk of cancer of the cheek and gum may reach nearly fifty-fold among long-term snuff users. Smokeless tobacco is becoming a large problem; the report found that in 1985 smokeless tobacco was used by at least 12 million people in the United States, and half of these were regular users. The use of smokeless tobacco is increasing among male adolescents and young male adults. The CDC's 1990 Youth Risk Behavior Survey reported that 19% of male high school students used smokeless tobacco.

Industrial Hazards

Industrial workers are especially susceptible to lung diseases due to the combined effects of cigarette smoking and exposure to certain toxic industrial substances, such as fumes from rubber and chlorine, and dust from cotton and coal. Exposure to asbestos in combination with cigarette smoking increases an individual's lung cancer risk nearly 60 times. Smoking also enhances lung cancer risk in underground miners exposed to radon.

NUTRITION AND CANCER

Evidence indicates that people may reduce their cancer risk by observing these nutrition guidelines:

1. Maintain desirable weight. Individuals 40% or more overweight increase their risk of colon, breast, prostate, gallbladder, ovary, and uterus cancers. Physicians can recommend a suitable diet and exercise regimen to help maintain an appropriate weight.

2. Eat a varied diet. A varied diet eaten in moderation offers the best hope for lowering the risk of cancer.

3. Include a variety of vegetables and fruits in the daily diet. Studies have shown that daily consumption of vegetables and fruits is associated with a decreased risk of lung, prostate, bladder, esophagus, and stomach cancers.

4. Eat more high-fiber foods such as whole grain cereals, breads, and pasta; vegetables and fruits. High-fiber diets may reduce risk of colon cancer. Such diets offer a healthy substitute for fatty foods.

5. Cut down on total fat intake. A diet high in fat may be a factor in the development of certain cancers, particularly breast, colon, and prostate.

6. Limit consumption of alcohol, if you drink at all. The heavy use of alcohol, especially when accompanied by cigarette smoking or smokeless tobacco use, increases risk of cancers of the mouth, larynx, throat, esophagus, and liver.

7. Limit consumption of salt-cured, smoked, and nitrite-cured foods. In areas of the world where salt-cured and smoked foods are eaten frequently, there is more incidence of cancer of the esophagus and stomach. The American food industry has developed new processes to avoid possible cancer-causing byproducts.

CANCER AND THE ENVIRONMENT

Most cancer cases in the United States are believed to be environmentally related, that is, associated in some way with our physical surroundings, personal habits, or lifestyles.

Some environmental causes are well known. About 30% of all cancer deaths are directly related to the use of tobacco. Most skin cancers result from ultraviolet radiation in sunlight.

Other causes are harder to assess. Diet is suspected as an important element in cancer risk, some say causing perhaps 35% of all cancer deaths. Much research is underway regarding the role diet and nutrition may play in the development of cancer.

Various occupational hazards, especially ionizing radiation and chemicals like asbestos, benzene, and vinyl chloride are known to cause cancer when exposure levels are high. Overall, however, workplace exposures account for only a small percentage of all cancers.

Cancer Risk Assessment

Evaluating the degree of cancer hazard posed by particular environmental risks is essential for developing environmental standards which protect people against unsafe exposure to chemicals and radiation. Assessment involves 1) identifying toxic properties of potentially oncogenic hazards and 2) measuring the extent of human exposure.

The first step, *hazard identification,* characterizes the chemical or physical nature of hazards and evaluates their toxicity both in observed human exposures and in laboratory tests using animals or cells. Special emphasis is given to evidence suggesting that cancer risk may increase with dose (dose-response relationships). The second step, *exposure measurement,* determines concentration levels of hazards in the environment (air, water, food, medications, workplace) and the extent to which people are actually exposed (how much they eat of a particular food, use particular medication, etc.) The true carcinogenic dose delivered to tissues and cells is estimated from information regarding pathways by which the body absorbs, metabolizes, and excretes toxins.

For most potential carcinogens, risk assessment involves two stages at which extrapolation of information is required: extrapolation of observed animal toxicity to what might be expected in humans and extrapolation of effects seen at high doses to what might be expected at low doses. In both procedures, conservative assumptions are made (for example, a linear no-threshold model for estimating low-dose effects) so that if risk assessment is in error, it will have erred on the side of safety. For cancer safety standards, only increased risks of one case or less per million persons per lifetime are usually accepted.

Such safety standards for chemical or radiation exposures form the basis for regulatory activities at the Food and Drug Administration, the Environment Protection Agency, and the Occupation Safety and Health Administration. The development of laws and procedures by which standards are implemented and risks are controlled is called "Risk Management."

The American Cancer Society

PROFILE

The Society traces its origins to 1913, when a group of ten physicians and five laymen met in New York City and founded the American Society for the Control of Cancer. Its stated purpose at the time was to "disseminate knowledge concerning the symptoms, treatment, and prevention of cancer; to investigate conditions under which cancer is found; and to compile statistics in regard thereto." Later renamed the American Cancer Society, it is today one of the oldest and largest voluntary health agencies in the United States, with over 2 million Americans united to conquer cancer through balanced programs of research, education, patient service, and rehabilitation.

Organization: The American Cancer Society, Inc. consists of a National Society, with 57 chartered Divisions and over 3,400 Units.

The National Society: A 212-member House of Delegates provides a basic representation from the 57 Divisions and additional representation on the basis of population. It elects and is governed by a Board of Directors of 130 voting members, half of whom are members of the medical or scientific professions.

The National Society is responsible for overall planning and coordination, provides technical help and materials to Divisions and Units, administers programs of research, medical grants and clinical fellowships, and carries out public and professional education on the national level.

The 57 Divisions: These are governed by members of Divisional Boards of Directors, both medical and lay, in all the states plus five metropolitan areas, the District of Columbia and Puerto Rico.

The Units: These are organized to cover the counties in the United States. There are thousands of community leaders who direct the Society's programs at this level.

The Programs: The Society maintains its priorities and goals through activities developed by the departments of Research, Detection and Treatment, Prevention, Public Information, Communications, Epidemiology and Statistics, Patient Services, Advocacy, and Income Development.

RESEARCH

The aim of the Society's research program is to determine what causes cancer and to support efforts to prevent and cure cancer. Quality research demands highly trained personnel, laboratory facilities, and supplies for each project—all are resources that cost money. The American Cancer Society is the largest private source of cancer research funds in the United States, second in total dollars spent only to the National Cancer Institute, an agency of the federal government.

The Society's overall annual investment in research has grown steadily from $1 million in 1946 to approximately $94 million in 1991. This sum represents slightly over 25% of the total expenditures of the Society. To date, the Society has invested more than $1.4 billion in cancer research. The success of the Society's Research Program is attested to by the fact that twenty-five Nobel Prize winners received grant support from the American Cancer Society early in their careers.

While most of the Society's research funding goes to support the work of outside investigators, within its National office ACS has long supported an active program of epidemiologic research. That program, in addition to analyzing trends in cancer occurrence (as illustrated by this report), has conducted several large prospective studies of cancer risk in American populations over the past 40 years. The earliest study demonstrated the effects of smoking on mortality and cancer risk in 188,000 men observed from 1952 through 1955. A broader study, conducted from 1959 through 1972 (Cancer Prevention Study I), encompassed 1 million men and women in 25 states and examined a wide range of potential cancer risk factors related to the environment and to individual lifestyles. A second such study is now in progress (Cancer Prevention Study II).

The American Cancer Society's Cancer Prevention Study II

One of the largest research studies ever carried out in the United States, CPS II, was launched in 1982. This long-term prospective study, is examining the habits and exposures of more than one million Americans. Causes of death among these people over subsequent years are being studied to learn how lifestyles and environmental factors affect the development of cancer.

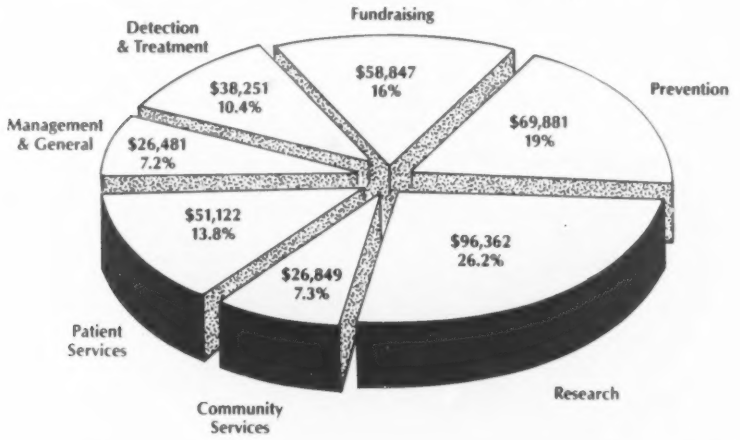
Over 77,000 volunteers enrolled 1.2 million men and women in the study. These volunteer researchers distributed a four-page confidential questionnaire to participants who were asked about their exposures to certain environmental conditions, their personal history of disease, and their lifestyles.

The goal of the study is to identify those factors that affect a person's chances of developing cancer by comparing mortality rates in differently exposed groups.

Many papers have been published from analyses of CPS II questionnaires and followup mortality data. One showed massive changes in American smoking habits compared with 23 years earlier in CPS I. Among men, 24% smoked, half as many as in the earlier study. More than twice as many had quit cigarette smoking. Another paper reported that death rates from all causes were 81% higher in obese and underweight people than those of average weight and that exercise was associated with

ALLOCATION OF AMERICAN CANCER SOCIETY FUNDS

Based on
Total 1990-91 Budget
$367,793



Figures taken from
1990 Annual Report
(in thousands)

reduced cancer mortality. Other papers have shown that among women, smokers die of lung cancer at a rate 12 times that of nonsmokers and that men who smoke have an increased risk of myeloid leukemia. Most recently, CPS II analyses have shown a relationship between regular aspirin use and reduced risk of fatal colon cancer.

Without the use of our volunteers, the cost of carrying out CPS II in its first eight years would have totalled more than $100 million. With volunteers to collect data, the study has cost only about $9 million.

The Research Program

The research program supports outside investigators, and focuses primarily on investigator-initiated projects. With the exception of staff and facilities to carry out its epidemiologic studies, the American Cancer Society neither hires staff researchers nor operates its own laboratories. This gives the Society the freedom to place its grants in leading centers across the country where the most innovative and promising ideas are being explored. In this way there is minimum overhead and maximum flexibility.

Applications for American Cancer Society grants are subjected to a rigorous process of external peer review, beginning with careful study by the appropriate one of 14 Scientific Advisory Committees each composed of 12-25 experts in their fields. The subjects range from studies of basic causes of cancer to how behavioral modifications may influence cancer prevention and treatment. The Council for Research and Clinical Investigations, a committee of approximately 20 senior scientists, examines the rank order of the applications approved by the Scientific Advisory Committee and recommends a payline based on the quality of the applications and the amount of money available. No member of a Scientific Advisory Committee or Council may serve on the Research and Clinical Investigation Committee or the National Board of Directors, which make the final funding decisions.

Types of Grants

The American Cancer Society Research Program offers five major types of grants: (1) Research and Clinical Investigation Grants to finance specific research projects; (2) Research Personnel Grants to provide salary support, both for established scientists and for postdoctoral fellows specializing in cancer research; (3) Institutional Research Grants to universities, institutes and hospitals to support pilot studies by new investigators; (4) Research Development Program Grants to provide rapid funding for priority projects; and (5) Special Institutional Grants to provide long-term funding for interdisciplinary projects.

Approximately 75% of the Society's research budget is made available to investigators in the form of **Research and Clinical Investigation Grants,** slightly more than 18% is allocated to the **Research Personnel Grants Program** and the remaining 6-7% is distributed among the **Institutional Research Grants Program,** the **Research Development Program** and the **Special Institutional Grants Program.** Special Institutional Grants on psychosocial and behavioral research and on nutrition are being funded as high priority areas.

The following types of awards are unique among granting agencies and deserve special mention.

Research Professorships. The Research Professorship program has been in existence since 1957. This award supports some of the nation's most gifted scientists from mid-career until retirement. These are people devoting their life's work to cancer research. Freed of major administrative responsibilities and other restrictions, they can concentrate on their fields of scientific investigation. There are currently 21 American Cancer Society Research Professors.

Clinical Research Professorships. These awards, which are similar to the Research Professorships, were initiated in 1987 to provide long-term support for outstanding clinician-scientists who bridge the gap between basic science and clinical medicine and thereby expedite clinical advances. Four such awards are currently in effect.

Physician's Research Training Fellowships. This type of Research Personnel Grant was inaugurated in 1981 to attract more MDs to cancer research. It provides an opportunity for physicians to take three years from their medical careers to train as researchers.

Research Development Program. This unique program was established to identify and provide funding for projects demonstrating unusually novel ideas or

urgent needs. Approved applications can be funded in less than three months compared with the nine months it may take to fund a new project through regular channels.

Frontiers in Cancer Research

Cancer research can be compared to an iceberg: the greater part of it, basic research and initial preclinical experimentation, is invisible to non-scientists. But it is a necessary foundation for the more visible clinical and epidemiologic research—the "tip" of the iceberg. The Society supports research in these areas—basic, preclinical, clinical, and epidemiologic. Discoveries in the laboratory are followed by the development of promising methods and techniques to control cancer. Once clinical research has demonstrated the effectiveness of new diagnostic and treatment methods, they are ready for application to patient care.

Examples of the latest findings in basic and preclinical cancer research, and the ways in which they are being transferred into the clinic to benefit the cancer patient, are described below.

Oncogenes. In the past several years, scientists have discovered major differences between normal and transformed, or tumorigenic, cells. Tumors result from non-hereditary (somatic) genetic defects, which may lead to the altered expression and/or structure of cellular gene products, causing functional changes that contribute to the initiation or progression of the neoplastic state.

Cellular oncogenes, of which more than 50 have been identified, are genes that are specifically turned on for only a brief moment during the cell cycle. They play a wide variety of roles in normal cells. Oncogene products may act as growth factors, as receptors for growth factors or as second messengers.

But when these oncogenes—or their regulators—are altered by mutations, they may operate continuously, resulting in unregulated cell growth.

In addition, we now know that there exist tumor suppressor genes, whose products may act at many of the same sites as those of oncogenes. In general, oncogene products will stimulate and suppressor gene products will impede or inhibit cell growth. Of particular interest and the subject of several of our grant applications, has been the expression of the p53 gene, located on the short arm of chromosome 17. This gene codes for a protein that has pivotal role in growth regulation, apparently functioning as a suppressor of tumor growth. An increasing number of investigators are finding mutations or even absence of this gene in people with certain forms of acquired and hereditary cancer. Normal oncogenes and suppressor genes are fundamental to all life processes, and many of them can be interchanged with their analogs in simple organisms such as yeast or fruit flies. This greatly facilitates laboratory investigations since these simple organisms are much easier to maintain and manipulate than mammalian organisms, including humans. Ultimately all advances need to be confirmed in human cells as part of a stepwise process.

Generally, cells must undergo several genetic changes, typically involving both oncogenes and suppressor genes, to become fully malignant. Several groups of scientists have tracked these changes and today we are very close to a comprehensive understanding of how a cancer cell develops. Since cancer is unquestionably caused by mutations in key genetic elements, it should be possible to design rational intervention strategies. Shutting off oncogenes or transplanting suppressor genes are both under active study.

Metastasis. Not only is it necessary to stop the growth of tumors at the primary site, but the subsequent spread of tumor cells into healthy tissues must also be prevented. It is this invasion, or metastasis, that most often leads to treatment failure. Researchers now understand how additional mutations in specific genes can cause cancer cells to produce increased amounts of destructive enzymes that allow them to penetrate and invade surrounding tissues, and they are within reach of revolutionary treatments that may restrict cancer cells to their point of origin. In the process of studying the enzymes that allow metastatic cells to spread, investigators have discovered a powerful new enzyme inhibitor, TIMP-2, that shows great promise in abolishing the metastatic potential of tumor cells. They have also identified a metastasis suppressor gene, NM23, that codes for a metastasis inhibitory protein. Already clinicians are using the presence of this NM23 protein in breast tumor tissue as a favorable prognostic indicator. By understanding the full mechanism of action of NM23, studies that will be aided by its also being found in lower organisms, it may be possible to develop a new anticancer drug that could mimic its effects.

Insights acquired through basic research contributed directly to the development of new techniques and methods which facilitate eventual clinical application.

Genetic Engineering. The two technologies that launched the current revolution in biology—recombinant DNA, which allows manipulation of individual genes, and hybridomas, which produce high-fidelity monoclonal antibodies—have profoundly altered cancer research and opened the way to new modes of diagnosis and treatment unimagined only 15 years ago. Recombinant DNA techniques are now employed routinely for producing large amounts of naturally occurring biological response modifiers such as growth factors, interferons, and tumor necrosis factor—many of which are already in clinical use. The correction of impaired immune systems and even the modification of hereditary susceptibility by transplanting foreign genes are other possibilities that derive from this powerful technology.

Researchers are also combining recombinant DNA with hybridoma technology to develop chimeric monoclonal antibodies that have both human and mouse components. These chimeric antibodies will be useful, because patients otherwise develop immune responses against portions of the traditional mouse monoclonal antibodies, precluding their repeated use. These engineered antibodies can also be produced by bacteria in vast quantities, significantly reducing their cost.

Polymerase Chain Reaction. The most spectacular addition to the biotechnology brigade is the polymerase chain reaction (PCR). This simple automated reaction can amplify minute amounts of DNA from a clinical specimen, even one obtained many years earlier. This is done by adding only primer sequences, nucleotides,

and an enzyme isolated from an obscure bacterium that grows in hot springs. The time needed to clone DNA fragments is cut by PCR from several weeks to a few hours. In cancer research, PCR has enabled the identification of chromosomal abnormalities and specific point mutations in oncogenes and tumor suppressor genes. The PCR technique was used to demonstrate the presence of p53 suppressor gene mutations in the germline of patients with Li-Fraumeni syndrome, a hereditary predisposition to breast cancer, and somatic (non-hereditary) mutations in this and other oncogenes in patients with breast and colon cancer. PCR has also been used to detect the rare presence of cancer-associated viruses, such as Epstein-Barr virus, human immunodeficiency (AIDS) virus, human T-cell lymphoma virus, hepatitis B virus (liver cancer), and human papilloma virus (cervical carcinoma).

PCR rapidly found its way into the practice of medicine. It is currently used in the analysis of genetic susceptibility to various diseases, and in tissue typing donors and recipients for transplantation. One of the most interesting applications of PCR is found in the diagnosis and prognosis of chronic myelogenous leukemia, which is associated with an abnormal translocation of one oncogene (abl) from one chromosome to another, where it is joined to another (bcr) gene with the resultant synthesis of an abnormal protein. PCR can find a single cancer cell lurking among millions of normal cells! Literally like finding a needle in a haystack, PCR can be done routinely now. The accuracy and simplicity of PCR technology in identifying viruses, as well as in locating mutations in oncogenes, will predictably have enormous impact on cancer diagnosis, prognosis, and treatment in the next decade.

Drug Development. Development of new cancer drugs is necessary for two reasons. One is that most cancer drugs are also toxic for normal cells and the aim is to develop drugs which will be less toxic for normal cells and more potent against tumor cells. Efforts must continue to discover the differences between normal and neoplastic cells. More useful drugs to exploit such differences can then be developed.

A second reason for the development of new anticancer drugs is the finding that cancer cells develop resistance to many natural and synthetic drugs; normal cells do not. Genes responsible for making cancer cells resistant to chemotherapy have recently been discovered. There are some exciting ideas of how to manipulate these genes to counteract drug resistance; this is a very active area of American Cancer Society sponsored research. Other novel treatments with radiation and surgical techniques are also yielding better ways to treat resistant cancers. Chemotherapy, given before radiation therapy, is being tested as a way to increase survival of patients with certain types of advanced cancer (i.e., lung and breast cancer).

Psychosocial and Behavioral Research

There is strong evidence that environmental factors and physical and mental conditioning influence a person's general health and chances of developing cancer, as well as the ability to cope with cancer if it occurs. Research on behavioral modifications is having a significant impact on symptoms of cancer and its treatment, such as pain, nausea, and vomiting. Other research deals with stress during treatment and during recovery after surgery or radiation treatment. A number of investigations concentrate on breast cancer, specifically on how women can be persuaded to make use of mammography screening, and how to adjust to surgery, if such intervention has been necessary.

It is an unfortunate fact that cancer occurrence and cancer fatalities are more frequent among socioeconomically disadvantaged population groups. The American Cancer Society through its Psychosocial and Behavioral Research Program and other programs is encouraging such investigations.

Other areas of investigation are approaching clinical application and quite a few discoveries are undergoing clinical trials.

PREVENTION

The American Cancer Society's Public Education programs are designed to inform people about cancer, tell them what they can do to protect themselves, and demonstrate related health habits.

The programs focus on two areas: cancer prevention which includes smoking control, the relationship between diet, nutrition, and cancer, and school health education; and the importance and value of periodic, cancer-related checkups and specific early cancer detection tests. Prompt action if one of cancer's seven warning signals occurs is also encouraged.

Six cancer sites account for the majority of cancer cases and about half of cancer deaths—colon and rectum, lung, breast, uterus, oral cavity, and skin. The Society's Public Education planning strategy emphasizes programs where prevention, risk reduction, and early detection practices realize the greatest return in terms of lives saved.

The Society's Public Education programs are divided into two categories: adult and youth. Adults are reached through worksites, healthsites, and the community in small group settings or on a one-to-one basis. Whenever possible, volunteers are selected on the basis of skills that can be readily adapted to Public Education. Volunteers include exsmokers with group experience who can help in smoking cessation programs, and health professionals who can teach breast self-examination to groups of women.

Youth programs are usually conducted as part of a comprehensive health education program in the schools. The programs are organized according to grade level and provide an age-appropriate message. These messages will affect cancer risk significantly through strategies designed to teach young people to adopt good health habits, to make health-enhancing lifestyle decisions, and, to understand health behavior as it relates to cancer risk reduction.

In 1991, the American Cancer Society's nationwide

Public Education programs reached 36 million adults and 35 million young people.

Programs on nutrition, tobacco, and breast health are the highest current priorities in Public Education. Recently released nutrition programs include Eating Smart for adults and Changing The Course for youth. Tobacco-related programs for adults include Smart Move, Special Delivery for pregnant women who smoke, and an involuntary tobacco program entitled, Where There's No Smoke. The program Special Touch is available to emphasize the importance of the early detection of breast cancer.

DETECTION AND TREATMENT

The Society's Professional Education Department provides health care professionals with the latest information on developments in cancer prevention, early detection, and treatment through national conferences and workshops, audiovisual and print publications, and clinical awards, professorships, and scholarships. Through a network of volunteers who are leaders in the fields of medicine, nursing, social work, dentistry, and other health care disciplines, the Society offers state-of-the-art information on cancer control with the ultimate goal of offering the American public the best possible opportunity to prevent cancer from occurring, to detect it early when it does occur, and to treat it with the best available technology.

Conferences and Workshops

The Detection and Treatment Department offers continuing medical education to physicians and other health care professionals through national conferences and workshops in which leaders in the field of cancer control present the latest information on various preventive strategies, diagnostic techniques, and therapies. The American Cancer Society is accredited by the Accreditation Council for Continuing Medical Education to sponsor continuing medical education. Attendance at these national conferences frequently qualifies for continuing education credits for other disciplines as well.

Audiovisuals, Journals, and Other Publications

Videotapes, slide programs, audiotapes, textbooks, proceedings of conferences and workshops, and booklets on key issues and treatments are examples of the publications the Society offers health care professionals to keep them up-to-date on the latest developments in cancer care. Emphasis is placed on strategies to prevent cancer and methods for detecting it in its earliest stages.

The Society publishes two national journals for health care professionals: *Ca-A Cancer Journal for Clinicians* and *Cancer*, a journal for those specializing in cancer research and in the care of the cancer patient.

Exhibits at National Health Care Meetings

To make health care professionals aware of the publications and services that the Society offers, the Detection and Treament Department exhibits at national meetings of health care organizations. Through these exhibits, physicians, nurses, and other practitioners can see books, pamphlets, and audiovisuals firsthand and learn about continuing education offerings and clinical awards.

Clinical Awards

Leading experts in oncology are supported to promote cancer education in medical, dental, and other appropriate schools through the Professors of Clinical Oncology award. Since the award's inception in 1970, the Society has funded 67 professors.

The National Clinical Awards Program was established in 1948 to provide broad support for oncology training at qualified hospitals and institutions. Over the past 40 years, Regular Clinical Fellowships and Junior Faculty Clinical Fellowships have had considerable impact on training physicians and dentists in oncology specialties, supporting the education of more than 9,600 individuals. Currently, funds are provided via the Clinical Oncology Fellowship (COF) and Clinical Oncology Career Development Award (CDA). The COF provides unique training opportunities for fellows to expand their expertise in oncology. The CDA is awarded to outstanding individuals who intend to pursue an academic career in oncology.

Through the Oncology Social Work Award, the Society offers traineeships for oncology social workers committed to research and clinical practice with cancer patients and their families. Each year awards are made to 24 master's and four post-master's candidates.

A new award program for primary care physicians was created in 1990. The Cancer Control Career Development Award is intended for family and general practice physicians who will serve as leaders in teaching, research, and clinical practice. Beginning in July 1990, three physicians were each awarded a total of $55,000 stipend support over the two years of the grant.

Nursing Programs

Cancer Nursing News, a free newsletter for nurses, provides up-to-date information on cancer, oncology nursing, the American Cancer Society, and opportunities in continuing education. Requests for subscriptions should be sent to the Executive Editor, *Cancer Nursing News*, c/o American Cancer Society, 1599 Clifton Road, N.E., Atlanta, GA 30329-4251.

Twenty new scholarships are awarded each year to qualified graduate students studying for a master's degree with a specialty in oncology nursing. Scholarships are $8,000 a year for up to two years, based on the student's continuing progress in the graduate program.

Professorships in oncology nursing are offered through the chartered Divisions of the Society. These professorships enhance the quality of care of cancer patients by increasing the focus on cancer education in schools of nursing.

Questionable Methods of Cancer Management

The Society monitors and maintains information on unproven methods of cancer management. Information

on such questionable treatments is closely reviewed by a committee of volunteer health care professionals, which periodically issues carefully researched position statements on these various "unconventional" treatments. These position statements are available to physicians, science writers, editors, and the general public.

PATIENT SERVICES

In 1991, approximately 665,000 cancer patients were reached through the innovative service and rehabilitation programs of the American Cancer Society.

Service Programs

Community Connection: Resources, Information, and Guidance Services. Specific information about cancer is provided, as well as referral to Society services and other resources in the community to meet the social, psychological, and other support needs of cancer patients and their families.

Transportation. Volunteer drivers provide transportation that enables patients to maintain their medical and continuing care programs.

Home Care Items. This program provides necessary home care supplies, and equipment to aid in the care and comfort of the patient.

Rehabilitation Programs

Look Good... Feel Better. This program is an opportunity for people undergoing cancer treatment to develop skills to improve their appearance. A program in partnership with the Cosmetic, Toiletry and Fragrance Association and the National Cosmetology Association, it focuses on cosmetic techniques that can help people cope with body changes resulting from cancer treatment.

Reach to Recovery. This program, the largest of the Society's patient-visitor programs, addresses the physical, psychosocial, and cosmetic needs of women who have or have had breast cancer. Carefully selected and trained volunteer visitors provide support and information. In addition, literature and services to help husbands, children, and friends of breast cancer patients are available.

CanSurmount. This is a short-term visitor program for cancer patients and their families. Hospital and home visits are made with the approval of the physician. The one-to-one visit by a person who has experienced the same type of cancer offers functional, emotional, and social support.

Laryngectomy Rehabilitation. Spearheaded by the International Association of Laryngectomees (IAL), this program is coordinated through more than 275 clubs. Laryngectomee visitors provide pre- and/or postoperative support to patients who undergo removal of the larynx.

Ostomy Rehabilitation. Some patients with intestinal or urinary cancers must have abdominal ostomies (surgically constructed openings for elimination of body wastes). Trained volunteers who have experienced this same type of surgery offer help on a one-to-one basis. Cooperating with the United Ostomy Association and enterostomal therapists, patients are assisted in their physical and psychological adjustment.

Patient and Family Education Programs

The Society sponsors group and individual education programs, distributes pamphlets and booklets and provides audiovisual presentations for patients of all ages and their families to help them understand and deal with the complexities of the disease.

I Can Cope. Information is provided on cancer and its treatments, nutrition, resource availability, and other issues of concern to cancer patients and their families.

COSTS OF CANCER

The financial costs of cancer are great both for the individual and for society as a whole. A study from the National Cancer Institute puts overall costs for cancer at $104 billion for 1990; $35 billion for direct medical costs; $12 billion for morbidity costs (cost of lost productivity), and $57 billion for mortality costs.* Earlier figures showed that cancer accounts for 10% of the total cost of disease in the US and that its share of the total cost of premature death was about 18% of all causes of death in 1985.

The cost of detection activities, including mammograms, Pap smears, and colorectal screenings adds another 3 to 4 billion dollars to overall cancer costs.

Individual medical costs may be covered by private insurance companies or public health insurance programs such as Medicare, Medicaid, and Veterans Affairs. Most of the nonelderly population receive their primary coverage through employment-based group insurance. Medicare covers medical costs for those over 65 and the disabled, about 31 million persons in 1989. Medicaid serves the poor, covering about 15 million of the nonelderly. About 33 million people, or about 14% of the population, had no health care coverage in 1989.

Traditionally, private and public insurers have been reluctant to cover cancer screening exams. In 1989 and 1990, Congress passed legislation mandating Medicare coverage for cervical and breast cancer screening, respectively. For women over age 65, Medicare currently covers a Pap smear once every three years and a mammogram every two years. Although this policy does not strictly conform to ACS screening recommendations (see page 18), it begins to address the benefits of early detection in reducing cancer costs.

*Brown, ML: Special Report: The national economic burden of cancer: an update. JNCI 1990; 82:1811-1814.

CANCER AROUND THE WORLD, 1986-88 Age-Adjusted Death Rates per 100,000 Population for Selected Sites for 50 Countries

Source of data: World Health Statistics Annuals 1987-1990.

COUNTRY	ALL SITES		ORAL		COLON & RECTUM		LUNG		BREAST	UTERUS		STOMACH		PROSTATE	LEUKEMIA	
	Male	Female	Male	Female	Male	Female	Male	Female	Female	Cervix	Other	Male	Female	Male	Male	Female
United States	163.2(24)	109.7(17)	3.8(30)	1.4(13)	17.2(22)	12.0(21)	56.9(12)	22.7(4)	22.4(16)	2.7(37)	2.7(33)	5.3(49)	2.3(49)	15.7(22)	6.3(10)	3.8(14)
Argentina*	152.0(30)	97.7(30)	4.2(25)	0.8(40)	13.3(33)	9.7(32)	39.3(33)	5.3(41)	20.4(21)	5.0(15)	6.7(4)	13.4(29)	5.6(32)	12.5(31)	5.2(30)	3.4(32)
Australia	162.8(25)	102.0(24)	4.6(20)	1.4(8)	21.6(9)	15.4(10)	44.8(28)	11.9(15)	20.6(19)	3.2(29)	2.0(48)	8.5(45)	3.6(47)	16.6(18)	6.1(11)	3.8(17)
Austria	174.0(19)	109.6(19)	5.9(14)	1.0(26)	22.0(8)	14.5(14)	45.9(27)	8.9(19)	22.2(17)	3.6(25)	5.4(10)	18.6(15)	9.1(14)	16.1(19)	5.6(25)	3.4(33)
Belgium*	204.8(4)	110.9(15)	3.5(32)	1.0(28)	19.5(14)	14.1(17)	77.2(1)	7.6(24)	26.8(6)	2.6(38)	3.8(22)	12.6(32)	5.9(30)	17.1(12)	6.0(14)	4.0(10)
Bulgaria	138.0(39)	84.2(40)	3.8(29)	0.7(43)	14.4(28)	10.0(30)	40.2(31)	6.4(34)	15.2(35)	3.8(24)	5.9(6)	21.3(12)	11.1(9)	7.7(42)	4.8(34)	3.3(36)
Canada	170.6(22)	111.5(14)	4.5(22)	1.3(16)	18.1(19)	12.9(19)	56.5(13)	19.5(7)	24.2(13)	2.4(39)	2.5(41)	8.4(46)	3.7(46)	16.7(17)	6.6(7)	3.9(11)
Chile†	141.2(37)	113.7(12)	2.1(44)	0.7(45)	6.9(41)	6.9(41)	21.1(41)	6.1(37)	12.6(40)	13.2(2)	2.4(43)	34.8(5)	14.1(7)	12.9(29)	4.0(44)	3.2(38)
China§#	148.2(34)	88.6(36)	2.6(39)	1.2(21)	7.6(40)	6.8(43)	32.8(34)	15.1(12)	4.7(48)	4.8(19)	—	31.2(6)	15.6(6)	—	4.0(42)	3.3(35)
Costa Rica	161.8(26)	115.8(11)	4.4(24)	1.1(24)	6.8(42)	7.5(39)	16.5(45)	6.0(38)	13.0(38)	12.7(3)	4.0(21)	49.9(2)	23.1(2)	18.3(7)	6.3(9)	4.6(3)
Cuba	129.0(41)	95.9(31)	5.4(17)	1.8(4)	9.7(38)	10.8(25)	39.8(32)	14.3(13)	15.5(31)	6.7(9)	7.0(3)	7.6(47)	3.7(45)	18.0(8)	4.8(36)	3.8(16)
Czechoslovakia	228.4(2)	119.9(8)	8.2(6)	1.0(27)	29.4(1)	16.4(6)	74.5(4)	8.1(21)	20.0(23)	5.9(12)	5.8(8)	20.2(13)	9.2(13)	13.2(27)	6.7(5)	4.4(5)
Denmark	182.2(12)	139.4(1)	3.8(28)	1.4(9)	23.6(5)	17.5(3)	53.8(17)	22.3(5)	28.3(2)	5.5(13)	3.6(24)	9.1(44)	4.7(41)	17.7(9)	7.1(3)	4.5(4)
Ecuador	83.9(48)	86.1(38)	0.9(50)	0.6(47)	3.1(47)	3.4(47)	7.1(49)	2.9(49)	5.7(47)	6.4(10)	14.0(1)	26.8(7)	19.1(3)	10.0(35)	3.6(47)	3.2(42)
England & Wales	181.9(13)	126.9(4)	2.8(37)	1.2(20)	20.2(12)	14.2(16)	60.9(9)	20.1(6)	29.3(1)	4.9(17)	2.6(39)	13.8(26)	5.6(33)	15.6(23)	5.4(28)	3.5(28)
Finland‡	158.9(27)	91.1(33)	2.2(41)	0.7(42)	11.9(36)	8.7(36)	52.2(18)	6.4(33)	17.3(27)	1.8(44)	2.7(32)	14.6(23)	7.7(21)	16.7(16)	5.2(29)	3.3(34)
France	204.7(5)	89.9(35)	14.3(2)	1.3(17)	18.1(20)	10.6(26)	46.5(25)	4.8(44)	19.6(24)	1.9(42)	4.3(16)	10.0(40)	3.9(44)	17.3(11)	6.4(8)	3.8(15)
Germany, Dem.	165.6(23)	102.9(22)	4.7(19)	0.9(36)	18.7(16)	14.5(13)	49.7(19)	5.7(40)	17.2(28)	5.9(11)	4.0(20)	18.1(18)	8.8(17)	10.5(34)	5.7(22)	3.7(19)
Germany, Fed.	181.2(16)	111.7(13)	6.0(13)	1.0(30)	21.4(10)	15.9(8)	48.7(21)	7.5(26)	23.2(14)	3.3(27)	3.3(26)	15.8(21)	8.3(18)	16.7(15)	6.0(12)	3.7(20)
Greece	143.8(36)	78.5(43)	1.6(46)	0.6(48)	6.1(43)	5.3(45)	48.6(22)	6.5(32)	15.4(32)	1.2(46)	3.3(27)	10.1(39)	5.3(35)	8.0(41)	5.9(16)	3.7(18)
Hong Kong†	181.6(14)	98.0(29)	14.8(1)	4.8(2)	15.3(24)	10.6(28)	57.3(11)	25.0(2)	8.4(43)	4.8(20)	1.5(49)	11.9(34)	6.9(24)	2.9(47)	3.6(48)	2.8(48)
Hungary	235.4(1)	129.4(3)	12.5(4)	1.6(7)	26.9(2)	17.9(2)	73.3(5)	13.2(14)	22.1(18)	7.3(8)	5.2(11)	24.4(10)	10.7(11)	15.9(21)	7.5(2)	4.4(6)
Iceland	137.2(40)	116.5(10)	2.9(36)	1.3(45)	12.4(35)	11.1(24)	27.4(37)	23.1(3)	20.4(22)	2.9(34)	2.6(37)	18.2(16)	5.1(37)	19.8(4)	5.5(26)	4.0(9)
Ireland	174.9(17)	126.1(5)	4.5(21)	1.4(14)	23.3(6)	16.6(4)	49.2(20)	17.7(9)	27.0(4)	3.1(31)	2.9(29)	13.5(28)	6.4(28)	16.8(14)	5.8(19)	3.8(13)
Israel†	117.6(44)	99.7(25)	1.3(48)	0.7(44)	14.2(30)	12.2(20)	23.2(40)	8.0(22)	22.9(15)	1.2(47)	2.9(30)	9.2(43)	4.6(42)	9.2(39)	6.0(15)	4.8(1)
Italy	193.7(10)	99.7(26)	6.4(11)	1.0(25)	15.5(23)	10.3(29)	58.8(10)	7.2(28)	20.6(20)	0.8(49)	5.6(9)	19.2(14)	9.0(16)	11.8(33)	6.6(6)	4.1(8)
Japan	149.8(32)	78.1(45)	2.2(43)	0.6(46)	14.2(29)	9.3(34)	28.6(36)	7.9(23)	6.0(46)	1.9(43)	2.8(31)	37.9(4)	17.2(4)	3.5(46)	4.6(39)	2.9(47)
Korea Republic†	150.3(31)	64.9(49)	1.5(47)	0.3(50)	4.2(46)	2.5(49)	20.1(42)	5.0(42)	2.6(49)	1.1(48)	5.9(7)	54.6(1)	23.7(1)	0.5(48)	2.9(49)	2.3(49)
Kuwait†	88.7(46)	77.0(46)	3.1(34)	2.4(3)	2.4(49)	6.9(42)	19.8(43)	6.1(36)	10.7(41)	2.9(33)	2.3(45)	5.5(48)	3.1(48)	5.0(44)	5.5(27)	3.9(12)
Luxembourg	217.5(3)	108.9(20)	7.6(7)	1.2(22)	25.5(3)	14.4(15)	71.8(6)	7.4(27)	25.6(10)	3.2(28)	5.9(13)	11.4(36)	5.2(36)	20.9(3)	8.6(1)	3.7(22)
Malta	145.3(35)	90.9(24)	4.4(23)	1.7(5)	14.5(27)	8.3(38)	44.4(29)	4.2(46)	26.7(9)	2.3(40)	4.6(15)	12.6(31)	6.3(29)	9.8(36)	7.0(4)	3.2(40)
Mexico*	77.3(49)	78.2(44)	1.7(45)	0.8(41)	3.1(48)	3.2(48)	15.2(48)	5.9(39)	7.2(45)	14.7(1)	3.0(28)	9.7(41)	7.7(20)	9.3(38)	3.7(46)	3.0(45)
Netherlands	200.6(8)	110.0(16)	2.6(40)	0.8(37)	19.0(15)	13.7(18)	75.5(3)	9.1(18)	26.8(8)	2.7(36)	2.6(35)	14.1(25)	5.7(31)	17.7(10)	5.8(20)	3.6(24)
New Zealand†	171.8(21)	124.3(6)	3.9(27)	1.4(12)	24.3(4)	21.5(1)	48.2(23)	15.7(11)	26.8(7)	5.0(16)	2.5(42)	10.7(37)	4.5(43)	17.1(13)	6.0(13)	4.7(2)
North Ireland	174.0(18)	123.0(7)	3.3(33)	1.0(32)	23.0(7)	16.5(2)	54.6(16)	17.5(10)	27.0(5)	3.3(26)	2.6(40)	13.7(27)	6.6(27)	13.8(25)	4.8(33)	3.1(44)
Norway	149.2(33)	102.1(23)	3.0(35)	0.9(33)	20.1(13)	14.6(12)	31.0(35)	9.3(17)	19.2(25)	4.6(21)	2.6(36)	11.8(35)	5.5(34)	21.2(2)	5.6(24)	3.5(30)
Panama†	87.2(47)	72.3(48)	3.6(31)	1.7(6)	5.6(44)	5.4(44)	15.5(47)	5.0(43)	7.6(44)	10.1(4)	2.6(34)	12.8(30)	6.8(25)	13.4(26)	4.2(41)	3.1(43)
Poland	200.1(9)	107.4(21)	5.8(15)	1.0(29)	13.9(31)	10.0(31)	67.5(7)	8.8(20)	15.2(33)	8.1(6)	4.2(18)	25.6(8)	9.0(15)	9.6(37)	5.7(21)	3.6(25)
Portugal	138.7(38)	83.8(41)	5.4(18)	0.8(39)	13.6(32)	9.4(33)	24.9(38)	4.0(47)	16.6(29)	2.2(41)	5.2(12)	24.7(9)	11.9(8)	12.8(30)	4.8(35)	3.4(31)
Puerto Rico†	121.7(43)	74.8(47)	9.0(5)	1.4(11)	9.0(39)	7.2(40)	17.9(44)	6.4(35)	13.2(37)	2.8(35)	3.6(23)	12.4(33)	5.1(38)	16.1(20)	4.0(43)	3.6(26)
Scotland	200.9(7)	136.1(2)	4.1(26)	1.2(18)	21.2(11)	15.9(7)	75.5(2)	27.1(1)	27.5(3)	4.8(18)	2.4(44)	14.2(24)	6.6(26)	13.9(24)	4.6(38)	3.2(37)
Singapore†	181.4(15)	109.7(18)	12.8(3)	4.8(1)	18.6(17)	15.1(11)	54.7(15)	19.3(8)	14.3(36)	7.6(7)	2.2(46)	24.1(11)	10.9(10)	4.8(45)	4.3(40)	3.2(41)
Spain*	157.9(28)	79.2(42)	5.7(16)	0.8(38)	11.8(37)	8.6(37)	40.5(30)	3.6(48)	15.7(30)	1.4(45)	4.1(19)	15.5(22)	7.6(22)	12.9(28)	5.0(32)	3.2(39)
Sweden†	127.7(42)	98.6(28)	2.8(38)	0.9(35)	14.7(25)	11.2(23)	24.0(39)	9.5(16)	17.4(26)	3.2(30)	2.6(38)	9.3(42)	4.8(40)	19.0(5)	5.0(31)	3.5(27)
Switzerland	173.9(20)	99.5(27)	6.5(10)	1.1(23)	18.6(18)	11.3(22)	46.8(24)	6.8(31)	25.1(12)	3.0(32)	3.4(25)	10.3(38)	5.0(39)	22.0(1)	5.9(18)	3.7(23)
Thailand†	54.4(50)	36.4(50)	1.3(49)	0.6(49)	1.6(50)	1.0(50)	5.5(50)	2.0(50)	1.0(50)	0.6(50)	2.0(47)	1.1(50)	0.6(50)	0.2(49)	1.1(50)	0.9(50)
Uruguay†	202.5(6)	118.3(9)	6.9(8)	1.2(19)	18.1(21)	15.5(9)	55.4(14)	4.3(45)	25.3(11)	4.6(22)	6.7(5)	16.3(20)	7.2(23)	19.0(6)	5.9(17)	4.2(7)
USSR	193.1(11)	92.9(32)	6.6(9)	1.0(31)	14.6(26)	10.6(27)	61.0(8)	6.9(30)	12.9(39)	5.4(14)	4.3(17)	38.4(3)	16.5(5)	5.9(43)	5.6(23)	3.7(21)
Venezuela†	92.2(45)	85.3(39)	2.2(42)	1.4(10)	5.0(45)	5.3(46)	16.4(46)	7.1(29)	9.6(42)	9.5(5)	8.0(2)	17.9(19)	10.4(12)	12.3(32)	3.9(45)	3.5(29)
Yugoslavia	152.4(29)	88.5(37)	6.1(12)	0.9(34)	13.0(34)	8.9(35)	46.5(26)	7.5(25)	15.2(34)	4.2(23)	4.9(14)	18.1(17)	8.2(19)	8.4(40)	4.7(37)	2.9(46)

NOTE: Figures in parentheses are order of rank within site and sex group. Rates are age-adjusted to the WHO world standard population.
*1986 only. †1986-87 only. ‡1987 only. #1987-88 only. §Oral cancer mortality rate includes nasopharynx only.

AMERICAN CANCER SOCIETY RESEARCH GRANTS & FELLOWSHIPS AWARDED DURING THE FISCAL YEAR (Subject to audit)

Albany Medical College, Albany, NY	(2)	$ 535,000
Albert Einstein College of Medicine, Bronx, NY	(13)	1,137,500
Amer. Assn. for Ca. Res., Inc., Philadelphia, PA	(1)	140,000
Baylor College of Medicine, Houston, TX	(9)	1,238,000
Beth Israel Hosp., Boston, MA	(4)	300,000
Boston College, Chestnut Hill, MA	(1)	205,000
Boston Univ., Boston, MA	(2)	283,000
Bowman Gray Sch. of Med., Winston Salem, NC	(5)	694,500
Brandeis Univ., Waltham, MA	(3)	328,000
Brigham & Women's Hosp., Boston, MA	(2)	415,000
Brigham Young University, Provo, UT	(1)	125,000
Brown University, Providence, RI	(2)	209,000
California Inst. of Technology, Pasadena, CA	(9)	721,900
Carle Foundation Hospital, Urbana, IL	(1)	77,000
Carnegie Institution, Washington, DC	(1)	10,000
Carnegie-Mellon Univ., Pittsburgh, PA	(1)	64,000
Case Western Reserve Univ., Cleveland, OH	(6)	972,000
Chicago Medical School, North Chicago, IL	(1)	190,000
Children's Hospital of Boston, Boston, MA	(2)	415,000
Children's Hospital of Los Angeles, CA	(3)	399,500
Children's Hospital of Pittsburgh, PA	(1)	55,000
City of Hope National Med. Ctr., Duarte, CA	(2)	282,000
Cleveland Clinic Foundation, Cleveland, OH	(2)	193,000
Cold Spring Harbor Lab., Cold Spring Hbr., NY	(6)	426,000
Columbia University, New York, NY	(9)	1,019,000
Cte. for Promotion of Med. Res., Yonkers, NY	(1)	75,000
Cornell University, Ithaca, NY	(2)	167,000
Cornell University, New York, NY	(5)	771,500
Dana-Farber Cancer Inst., Boston, MA	(6)	962,500
Dartmouth College, Hanover, NH	(7)	1,665,000
Drexel University, Philadelphia, PA	(1)	88,000
Duke University, Durham, NC	(15)	2,034,720
East Carolina University, Greenville, NC	(2)	167,500
Eleanor Roosevelt Inst. for Ca. Res., Denver, CO	(2)	110,000
Emory University, Atlanta, GA	(4)	593,500
Foundation for Biomedical Res., Washington, DC	(1)	10,000
Fred Hutchinson Cancer Res. Ctr., Seattle, WA	(8)	850,500
George Washington Univ., Washington, DC	(1)	34,000
Georgetown Univ., Washington, DC	(4)	745,000
Gordon Research Conf., Kingston, RI	(1)	10,000
Harvard University, Cambridge, MA	(7)	480,400
Harvard Medical School, Boston, MA	(11)	1,188,500
Henry Ford Hospital, Detroit, MI	(1)	113,000
Hope College, Holland, MI	(1)	36,500
Howard University, Washington, DC	(1)	57,000
Indiana University, Bloomington	(2)	144,000
Indiana University, Indianapolis	(4)	615,000
Inst. for Cancer Res., Philadelphia, PA	(6)	694,000
Inst. for Hormone Res., New York, NY	(1)	58,208
Int'l Union Against Cancer, Geneva, Switzerland	(2)	680,000
Inter. Council for Coord. Cancer Res., NYC	(1)	10,000
Iowa State University, Ames	(1)	50,000
Jackson Laboratory, Bar Harbor, ME	(1)	30,000
Jewish Hospital of St. Louis, MO	(1)	200,000
Johns Hopkins Univ., Baltimore, MD	(22)	2,190,200
Joslin Diabetes Center, Boston, MA	(1)	256,000
Kansas State University, Manhattan, KS	(2)	288,000
Lab. of Molecular Genetics, Strasbourg, France	(1)	71,000
Lehigh Univ., Bethlehem, PA	(1)	60,000
Louisiana State Univ., New Orleans, LA	(1)	100,000
Louisiana State Univ., Shreveport	(2)	215,000
Loyola Univ. of Chicago, Maywood, IL	(1)	186,000
Marine Biological Laboratories, Woods Hole, MA	(2)	100,500
Massachusetts General Hosp., Boston	(8)	889,500
Massachusetts Inst. of Tech., Cambridge, MA	(8)	567,540
Medical Biology Institute, La Jolla, CA	(1)	95,000
Medical Coll. of Virginia, Richmond	(4)	$ 588,000
Medical Coll. of Wisconsin, Milwaukee	(4)	447,000
Mem. Cancer Institute, Long Beach, CA	(1)	84,000
Mem. Sloan Kettering-Mem. Hosp. for Ca. & All. Dis., NYC	(13)	1,072,500
Miami University, Oxford, OH	(1)	80,000
Michigan Cancer Foundation, Detroit, MI	(2)	218,000
Michigan State Univ., East Lansing	(3)	259,500
Montana State University, Bozeman	(2)	212,000
Montefiore Medical Center, Bronx, NY	(1)	104,000
Mount Sinai Med. Center, New York, NY	(6)	479,000
Nat'l Acad. of Science, Washington, DC	(1)	50,000
Nat'l Institutes of Health, Bethesda, MD	(3)	163,000
Nat'l Jewish Ctr. for Immun. & Res., Denver, CO	(2)	303,000
New England Deaconess Hosp., Boston, MA	(2)	315,000
New England Med. Ctr. Hospitals, Boston, MA	(4)	842,000
New York Medical College, Valhalla, NY	(1)	95,000
NY State Dept. of Health-Roswell Park, Buffalo	(9)	1,105,000
NY State Dept. of Health-Wadsworth Ctr., Albany	(1)	45,000
New York University, New York	(13)	1,433,000
North Carolina State Univ., Raleigh	(1)	26,000
Northwestern Univ. Chicago, IL	(3)	191,766
Oak Ridge Nat'l Lab., Oak Ridge, TN	(1)	118,000
Ohio State Univ., Columbus	(4)	302,000
Oklahoma Med. Res. Fdn., Oklahoma City	(1)	90,500
Oregon Health Science Univ., Portland	(3)	305,917
Oregon State Univ., Corvallis	(1)	10,000
Pennsylvania Hosp., Philadelphia, PA	(1)	40,000
Pennsylvania State Univ., Univ. Park	(3)	389,500
Pennsylvania State Univ., Hershey	(1)	90,000
Princeton Univ., Princeton, NJ	(9)	767,460
Pub. Health Res. Inst., New York, NY	(2)	218,000
Purdue Univ., West Lafayette, IN	(3)	212,500
Reed College, Portland, OR	(2)	250,000
Rockefeller Univ., NYC	(6)	651,000
Rush Presbyterian-St. Luke's Medical Center	(2)	296,000
Rutgers Univ., New Brunswick, NJ	(2)	256,000
St. Jude Children's Res. Hosp., Memphis, TN	(3)	242,000
St. Louis Univ., St. Louis, MO	(3)	420,000
St. John's Univ., Jamaica, NY	(2)	389,000
Salk Inst. for Biological Studies, San Diego, CA	(5)	483,000
Scripps Clinic Res. Fdn., La Jolla, CA	(4)	184,600
SRI International, Menlo Park, CA	(1)	100,000
Stanford Univ., Stanford, CA	(27)	2,428,440
State Univ. of NY, Brooklyn	(2)	178,500
State Univ. of NY, Buffalo	(1)	240,000
State Univ. of NY, Syracuse	(1)	180,000
State Univ. of NY, Stony Brook	(5)	386,000
Temple University, Philadelphia, PA	(1)	122,000
Thomas Jefferson University, Philadelphia, PA	(2)	205,000
Tufts Univ., Boston, MA	(5)	710,500
Tulane Univ., New Orleans, LA	(2)	107,000
UMDNJ-Robert Wood Johnson Med. Sch., Piscataway, NJ	(3)	552,000
UMDNJ-Newark, Newark, NJ	(3)	311,000
University Hospitals of Cleveland, Cleveland, OH	(1)	90,500
Univ. of Alabama, Birmingham	(4)	579,000
Univ. of Arizona, Tucson	(6)	561,500
Univ. of Arkansas for Med. Sci., Little Rock	(4)	579,000
Univ. of Calif. at Berkeley	(8)	722,865
Univ. of Calif. at Davis	(6)	618,000
Univ. of Calif. at Irvine	(8)	1,017,000
Univ. of Calif. at Los Angeles	(11)	1,416,184
Univ. of Calif. at San Diego	(16)	1,749,450
Univ. of Calif. at San Francisco	(17)	1,608,770
Univ. of Calif. at Santa Barbara	(4)	396,500
Univ. of Calif. at Santa Cruz	(1)	$ 90,500
Univ. of Chicago, Chicago, IL	(10)	1,174,758
Univ. of Cincinnati, Cincinnati, OH	(1)	95,000
Univ. of Colorado, Boulder	(4)	460,000
Univ. of Colorado Health Sci. Ctr., Denver	(7)	734,000
Univ. of Connecticut Health Ctr., Farmington	(3)	362,000
Univ. of Delaware, Newark	(1)	203,000
Univ. of Georgia, Athens	(2)	239,000
Univ. of Hawaii, Honolulu	(2)	115,000
Univ. of Illinois at Chicago	(7)	1,217,000
Univ. of Illinois at Urbana-Champaign	(1)	100,000
Univ. of Iowa, Iowa City	(3)	354,000
Univ. of Kentucky, Lexington	(1)	30,000
Univ. of Louisville, Louisville, KY	(2)	222,000
Univ. of Maryland, Baltimore	(7)	943,500
Univ. of Massachusetts Med. Ctr., Worcester	(3)	207,500
Univ. of Miami, Coral Gables, FL	(2)	149,000
Univ. of Michigan, Ann Arbor	(15)	1,918,498
Univ. of Minnesota, Minneapolis	(10)	1,157,500
Univ. of Missouri, Columbia	(1)	200,000
Univ. of Nebraska, Lincoln	(2)	273,500
Univ. of Nebraska Med. Ctr., Omaha	(1)	40,000
Univ. of Nevada, Reno	(2)	270,500
Univ. of New Hampshire, Durham	(1)	70,000
Univ of New Mexico, Albuquerque	(4)	406,700
Univ. of New Orleans, New Orleans, LA	(1)	170,000
Univ. of North Carolina, Chapel Hill	(16)	2,092,500
Univ. of Oregon, Eugene	(5)	331,110
Univ. of Pennsylvania, Philadelphia, PA	(12)	1,342,000
Univ. of Pittsburgh, Pittsburgh, PA	(10)	1,365,500
Univ. of Rochester, Rochester, NY	(10)	1,183,000
Univ. of South Alabama, Mobile, Alabama	(1)	90,500
Univ. of South Carolina, Columbia	(2)	130,500
Univ. of South Florida, Tampa	(1)	119,000
Univ. of Southern California, Los Angeles, CA	(7)	934,000
Univ. of Tennessee, Memphis	(1)	113,000
Univ. of Texas, Austin	(1)	47,000
Univ. of Texas Southwestern Med. Ctr., Dallas	(8)	958,000
Univ. of Texas Med. Branch, Galveston	(1)	55,000
Univ. of Texas Health Science Ctr., Houston	(5)	597,500
Univ. of Texas System Ca. Ctr. (MD Anderson)	(9)	1,227,000
Univ. of Texas, San Antonio	(4)	259,000
Univ. of Utah, Salt Lake City	(5)	399,500
Univ. of Vermont, Burlington	(3)	259,000
Univ. of Virginia, Charlottesville	(8)	734,000
Univ. of Washington, Seattle	(9)	1,236,600
Univ. of Wisconsin, Madison	(18)	2,211,375
Univ. of Wisconsin, Milwaukee	(1)	99,000
Vanderbilt University, Nashville, TN	(6)	690,500
Virginia Mason Res. Ctr., Seattle, WA	(2)	193,000
Washington State Univ., Pullman, WA	(1)	35,000
Washington Univ., St. Louis, MO	(9)	1,056,500
Wayne State Univ., Detroit, MI	(4)	627,000
Wesleyan University, Middletown, CT	(1)	90,000
West Virginia University, Morgantown	(1)	50,000
Western Consortium for Public Health, Berkeley	(1)	180,000
Whitehead Institute, Cambridge, MA	(7)	480,595
Witchita State Univ., Witchita, KS	(1)	132,000
William Paterson College of NJ, Wayne, NJ	(1)	207,000
Wistar Institute, Philadelphia, PA	(5)	921,000
Worcester Fdn. for Exp. Biol., Shrewsbury, MA	(1)	24,000
Yale Univ., New Haven, CT	(20)	2,498,522
SUBTOTAL	(803)	90,954,078
Division Research Grants		3,252,464
TOTAL		94,207,142

Note: Numbers in parentheses indicate number of grants per institution.

CANCER CENTERS

The institutions listed have been recognized as Cancer Centers by the National Cancer Institute. These centers have been rigorously reviewed by the National Cancer Advisory Board. They receive financial support from the National Cancer Institute, the American Cancer Society and many other sources.

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Comprehensive Cancer Center
(205) 934-5077

ARIZONA
Arizona Cancer Center*
University of Arizona
(602) 626-6044

CALIFORNIA
Kenneth Norris, Jr. Comprehensive Cancer Center*
University of Southern California
(213) 224-6600

Jonsson Comprehensive Cancer Center*
University of California at Los Angeles
(213) 825-3181

La Jolla Cancer Research Foundation
(619) 455-6480

UCSD Cancer Center
University of California at San Diego Medical Center
(619) 534-1501

Beckman Research Institute City of Hope
(818) 357-9711

Armand Hammer Center for Cancer Biology
Salk Institute
(619) 453-4100

California Institute of Technology Cancer Center
(818) 356-6408

COLORADO
University of Colorado Cancer Center
University of Colorado Health Sciences Center
(303) 270-8801

CONNECTICUT
Yale Comprehensive Cancer Center*
(203) 785-4095

DISTRICT OF COLUMBIA
Lombardi Cancer Research Center*
Georgetown University Medical Center
(202) 687-2110

FLORIDA
Sylvester Comprehensive Cancer Center*
University of Miami Medical School
(305) 548-4800

ILLINOIS
Illinois Cancer Center
(312) 226-2379

University of Chicago Cancer Research Center
(312) 702-6180

INDIANA
Purdue University Cancer Research Center
(317) 494-9129

MAINE
The Jackson Laboratory
(207) 288-3371

MARYLAND
Johns Hopkins Oncology Center*
(301) 955-8822

MASSACHUSETTS
Dana-Farber Cancer Institute*
(617) 732-3000

Worcester Foundation for Experimental Biology
(508) 842-8921

Massachusetts Institute of Technology
Center for Cancer Research
(617) 253-642101

MICHIGAN
Comprehensive Cancer Center*
Wayne State University
(313) 745-8870

University of Michigan Cancer Center
(313) 936-2516

MINNESOTA
Mayo Comprehensive Cancer Center*
(507) 284-4718

NEBRASKA
Eppley Institute
University of Nebraska Medical Center
(402) 559-4238

NEW HAMPSHIRE
Norris Cotton Cancer Center*
Dartmouth-Hitchcock Medical Center
(603) 646-5505

NEW YORK
Cold Spring Harbor Laboratory
(516) 367-8310

Memorial Sloan-Kettering Cancer Center*
(212) 639-6561

Roswell Park Cancer Institute*
(716) 845-5770

Cancer Research Center
Albert Einstein College of Medicine
(212) 430-2302

Columbia University Comprehensive Cancer Center*
(212) 305-6921

New York University Medical Center
(212) 340-5349

University of Rochester Cancer Center
(716) 275-4911

Institute for Environmental Medicine
New York University Medical Center
(212) 340-5280

American Health Foundation
(212) 953-1900

NORTH CAROLINA
Duke Comprehensive Cancer Center*
(919) 684-3377

Lineberger Cancer Research Center
University of North Carolina*
(919) 966-3036

Comprehensive Cancer Center*
Wake Forest University
Bowman Gray School of Medicine
(919) 748-4464

OHIO
Comprehensive Cancer Center*
Ohio State University
Arthur G. James Cancer Hospital
(614) 293-3302

Ireland Cancer Center
Case Western Reserve University
(216) 844-8453

PENNSYLVANIA
Fox Chase Cancer Center*
(215) 728-2781

University of Pennsylvania Cancer Center*
(215) 662-6334

Wistar Institute Cancer Center
(215) 898-3703

Fels Research Institute
Temple University School of Medicine
(215) 221-4307

Pittsburgh Cancer Institute*
University of Pittsburgh
(412) 647-2072

RHODE ISLAND
Brown University Cancer Center
Roger Williams General Hospital
(401) 456-2070

TENNESSEE
Drew-Meharry-Morehouse
Consortium Cancer Center
(213) 754-2961

St. Jude Children's Research Hospital
(901) 522-0301

TEXAS
M.D. Anderson Cancer Center*
University of Texas
(713) 792-6000

Cancer Therapy and Research Center
(512) 616-5580

UTAH
Utah Regional Cancer Center
University of Utah Health Sciences Center
(801) 581-8793

VERMONT
Vermont Regional Cancer Center
University of Vermont
(802) 656-4414

VIRGINIA
Massey Cancer Center
Medical College of Virginia
(804) 786-9722

University of Virginia Medical Center
(804) 924-5111

WASHINGTON
Fred Hutchinson Cancer Research Center*
(206) 467-4302

WISCONSIN
Comprehensive Cancer Center*
University of Wisconsin
(608) 263-8610

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*Indicates Comprehensive Cancer Center.

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MISSION STATEMENT

The American Cancer Society is the nationwide, community-based, voluntary health organization dedicated to eliminating cancer as a major health problem by preventing cancer, saving lives from cancer, and diminishing suffering from cancer through research, education, and service.

National Headquarters: American Cancer Society, Inc., 1599 Clifton Road N.E., Atlanta, GA 30329-4251

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